ProHD

HEVC
H.265 - HIGH EFFICIENCY VIDEO CODING

ProHD BR-EN900

HEVC Encoding and Streaming Appliance

User Manual

Version 2.2

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Contents

Copyright Notice

http://www.jvc.com/

Open Source Documentation

The software included in this product contains open source software components licensed under open source licenses (such as GPL - General Public License).

For information about copyright holders and licenses, or to receive a copy of the corresponding source code to which you may be entitled under the applicable open source license, contact JVC representative.

Safety Instructions

- Use the following safety guidelines to help protect your ProHD BR-EN900 unit from potential damage and to ensure your own personal safety.
- Make sure that only authorized personnel installs, connects and maintains ProHD BR-EN900 and its components.
- Read and follow all instructions marked on the product and in the documentation before you operate your system. Retain all safety and operating instructions for future use.
- As a power switch is not incorporated in the equipment, the power plug must be disconnected to unpower the unit.

When using ProHD BR-EN900

- Install the system on secured and stable surface.
- To help prevent electric shock, plug the power cable into properly grounded sources. Use only properly grounded extensions and adapters as the need arises.
- Make sure that nothing rests on your ProHD BR-EN900 power cable and that the cables are not located where they can be stepped or tripped over.
- Do not spill food or liquids on your ProHD BR-EN900 unit.
- Keep your ProHD BR-EN900 unit away from radiators and heat sources. Do not place your ProHD BR-EN900 unit on a bed, sofa, or rug.
- When you disconnect a power cable, pull on its connector or on its strain relief loop not on the cable itself.
- **ESD Warning**: Normal handling precautions should be taken to avoid static discharge.

WARNING:

Do not try to open or replace parts as this will void your warranty.

Declaration of Conformity and Regulatory Compliance

USA: FCC Part 15 Class A

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

WARNING:

Modifying the equipment without JVC authorization may result in the equipment no longer complying with FCC requirements for Class A digital devices. In that event, your right to use the equipment may be limited by FCC regulations, and you may be required to correct any interference to radio or television communications at your own expense.

Canada: ICES-003

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

European Union - European Economic Area (EEA):

This product fulfills the essential requirements of the below European directives and thus bears the CE marking.

2014/108/EU	Electromagnetic Compatibility (EMC)
2014/35/EU	Low voltage (LVD)
2011/65/EU	Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS recast)

The following relevant harmonized standards were used during the assessment process:

EN 60950-1 Information technology equipment - Safety -- Part 1: General requirements

EN 61000-3-2 Limits for harmonic current emissions

EN 61000-3-3 Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems

EN 55022 Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement

EN 55024 Information technology equipment - Immunity characteristics - Limits and methods of measurement

Per directive 2012/19/EU (Waste of Electrical and Electronic Equipment - WEEE), this product

must not be disposed of as unsorted waste and must be collected separately.

For more information on JVC's compliance to material restriction regulations or to request a declaration of conformity, please contact your JVC representative.

CHAPTER 1

About This Manual

In This Chapter

General

Information in this document is subject to change without notice. JVC assumes no responsibility for any errors that may appear in this manual. Companies, names and data used in examples herein are fictitious unless otherwise noted. No part of this document may be copied or reproduced in any form, or by any means, electronic or mechanical, for any purpose, without the express written permission of JVC. JVC provides no warranties with respect to this documentation and disclaims any implied warranties of merchantability or fitness for a particular purpose. From time to time changes may occur in the file names and in the files actually included on the distribution disks. JVC provides no warranties that such files or facilities, as mentioned in this documentation, exist on the distribution disks or as part of the materials distributed.

Manual Structure and Use

This manual is structured in a modular format, containing the following sections:

- ProHD BR-EN900 Overview (on page 9)

  Describes the ProHD BR-EN900 product, its system requirements and I/O specifications.
- Getting Started (on page 15)

  Describes how to connect to the appliance for the first time.
- Setup and Operations (on page 22)

  Describes how to set and configure ProHD BR-EN900 appliance, obtain an event log and upgrade software and firmware versions.
- ProHD BR-EN900 Reset (on page 60)

  Describes how to reset the appliance.
- Firmware Upgrade (on page 61)

  Describes how to upgrade ProHD BR-EN900 firmware.
- ProHD BR-EN900 Playback (on page 65)

  Describes how to set up players to view ProHD BR-EN900 channels playback.

CHAPTER 2

ProHD BR-EN900 Overview

In This Chapter

The Product

ProHD BR-EN900 is an HEVC (H.265) and MPEG-4 Part-10 (H.264) hardware encoding and streaming appliance, designed to support a diverse set of video streaming applications. ProHD BR-EN900 features a wide range of inputs, including HD-SDI, SDI, HDMI, DVI and Composite, user-intuitive web management software with full control of all H.265 and H.264 compression settings. In addition to video and audio interfaces - the appliance supports a wide range of streaming protocols, including UDP TS, RTP TS, RTP ES, and RTMP. For an artifact/glitch free video experience, ProHD BR-EN900 also provides either Pro-MPEG forward error correction (FEC) or proprietary Zixi™ real time protection (able to correct networks errors up to 30%).

To get the best performance out of ProHD BR-EN900 based on your application, ProHD BR-EN900 introduces easy-to-use encoding profiles based on end-user application.

Powered by JVC GEN2+ HEVC hardware codec, ProHD BR-EN900 provides pristine video encoding quality at low bitrate. The encoder supports up to 4:2:2, 10bits encoding as well as IBP frames for the most demanding broadcast applications.

It also includes a secondary hardware-based MPEG4-H.264 chip that can be used in parallel to the HEVC H.265 core to generate a backward compatible stream from the same video source to be used with legacy decoders or using a separate video source for creating a second IPTV service from the same appliance.

ProHD BR-EN900 contains hardware and software foundations for additional enhancements. JVC continues to develop more features and more capabilities and will make firmware upgrades available through its online Support Portal and through standard product announcements. For more information about the ProHD BR-EN900 future capabilities, contact JVC or the JVC channel partner you have acquired the appliance from.

System Requirements

Operating System:

- Microsoft ® Windows 2003 ®
- Microsoft ® Windows 2008 ®
- Microsoft ® Windows 2012 ®
- Microsoft ® Windows 7 ®
- Microsoft ® Windows 8.0 / 8.1 ®
- Microsoft ® Windows 10.0 ®
- Apple ® MAC OS ® 10.8 or higher

Internet Browser:

- Edge 38 ® or higher
- Internet Explorer 11 ® or higher
- FireFox 36.0 ® or higher (Windows and Mac)
- Safari 9.0 ® or higher (Mac)
- Google Chrome ™ 49.0 or higher

Licensing

The license of the ProHD BR-EN900 provides HD/SD encoding and streaming capabilities, (HEVC and H.264), Zixi™streaming, and Pro-MPEG SMPTE-2022 Forward Error Correction.

I/O Specifications

ProHD BR-EN900 Front Panel

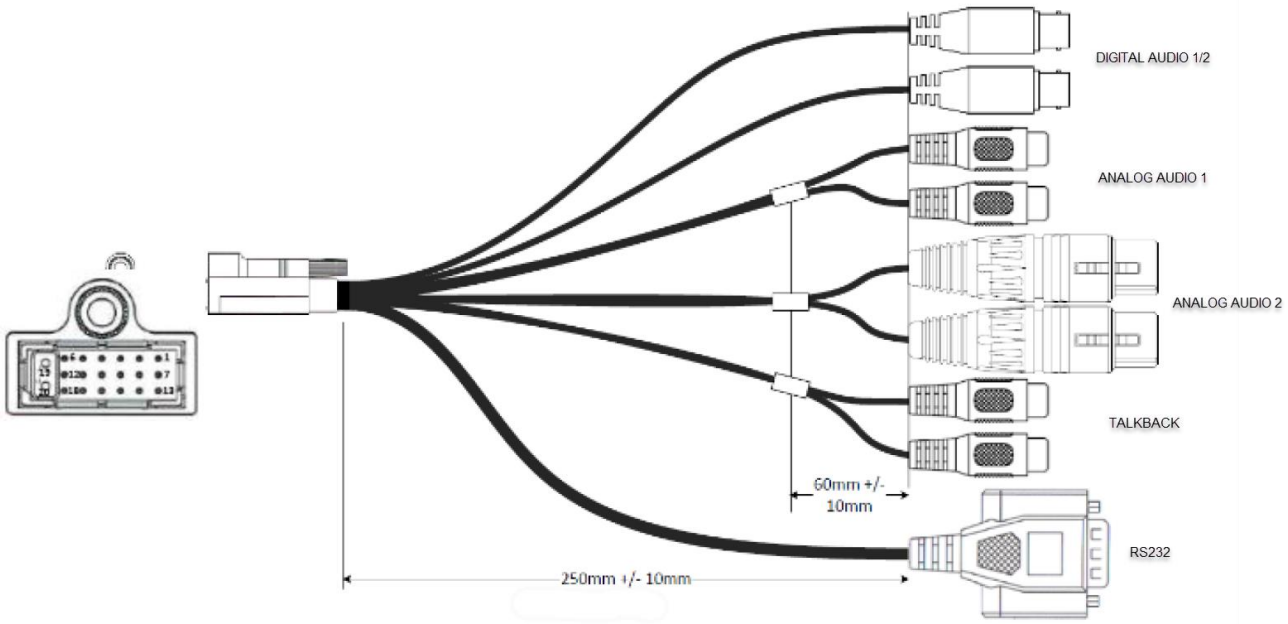
LED/ Port	LED Status	Description
Power LED	• Off • Green • Blinking green once per second • Blinking green twice per second	• The appliance is off. • The appliance is up and ready • The appliance is starting • The appliance is being upgraded.
Error LED	• Off • Red	All services are running smoothly. • An error occurred in one or more services: - Steady on – channel error - Blinking once per second – abnormal temperature - Blinking twice per second – fan error.
Video In LED	• Off • Green	• No video input • Video input is detected on one or more interfaces.
Stream LED	• Off • Green	• No stream • Streaming
USB Port		USB connection for retrieving network parameters.

LED/ Port	LED Status	Description
Reset		A short press will restart the appliance. A long press (6 seconds) will return the unit to factory settings (erasing all user-stored channel and network settings). Pressing for 2-3 seconds while powering the appliance will re-load the last known good firmware.

ProHD BR-EN900 Rear Panel

Connector Label	Connectors	Description
Ethernet 1	RJ-45	Gigabit Ethernet for streaming and management.
Ethernet 2	RJ-45	Gigabit Ethernet for streaming and management
POWER 20-50 VDC	Multi-pin connector	Power input.
Serial/Audio	Multi-pin connector	Breakout cable for audio inputs, and talkback audio output.
DVI-D IN	DVI (female)	DVI-D input.
HDMI IN	HDMI (female)	HDMI input (v1.3).
SDI IN	BNC	SDI input (SD and HD). 3G-SDI is compliant with SMPTE 425-A (= 3G-A).
CVBS IN	BNC	Composite Input
SDI OUT	BNC	SDI preview output Video input preview of the H.264 or H.265 channel.

ProHD BR-EN900 Breakout Cable



Connector Label	Connectors	Description
Digital Audio 1/2	BNC	Unbalanced Stereo Digital Audio input (AES)
Analog Audio 1	RCA Female	Unbalanced Stereo Analog Audio input (line level)
Analog Audio 2	XLR Female	Balanced Stereo Analog Audio input
Talkback	RCA Female	Unbalanced Stereo Analog Audio output for Talkback (line level)
RS232	DB9	Not in use

CHAPTER 3

Getting Started

In This Chapter

Initial Connection and Setup

The ProHD BR-EN900 is configured, by default, to use a fixed static IP address for its Ethernet Port 1. Use the default **192.168.1.1** IP address to perform initial login from a computer connected directly to the platform.

By default, Ethernet Port 2 is configured with DHCP mode.

To configure the appliance's network settings for the first time:

2. Connect a power source to the rear power input port.
3. Connect the network port labeled "Ethernet 1" to a computer in the **192.168.1.x** range with subnet **255.255.255.0** and ensure you can ping the default IP address of the unit to **192.168.1.1.**
4. Either use an Internet browser or open an SSH terminal.

To configure the appliance's network settings for the first time through the browser:

1. Type the appliance's IP address in the URL field. The login window appears.

Figure 3-1: The Login window

2. Type the password (the default password is **"jvc1234"**) and click the blue arrow. The ProHD BR-EN900 interface is loaded.

3. From the main menu, select **System.** The system page opens.

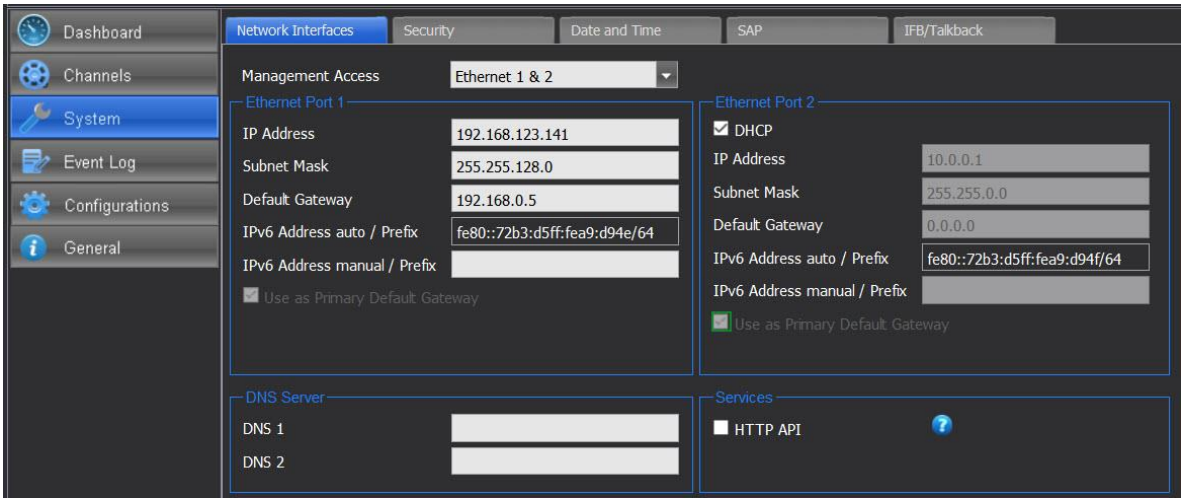


Figure 3-2: The System page

4. Set the following parameters and click **Apply.**

CAUTION:

When you change the unit's IP address to use a different subnet you may need to reconfigure your computer network settings to re-connect to the appliance.

Parameter	Description
Management Access	Select the Ethernet Port used for management (Ethernet Port 1, 2 or 1&2)
IP Address/IPv6 Address/Prefix	Enter a static IP/Prefix address.
Subnet Mask	Enter the subnet mask address.
Default Gateway	Enter the gateway/v6 address
Enable DHCP (Ethernet Port 2)	Select this box to enable automatic retrieval of IP address and DNS server information from the DHCP server.
DNS1	Optional field - required if a domain name is used instead of an IP address (RTMP protocol).
DNS2	Optional field - required if a domain name is used instead of an IP address (RTMP protocol).

Logging on

ProHD BR-EN900 requires a password to logging on.

To log on to ProHD BR-EN900:

1. Connect to the ProHD BR-EN900 web interface by entering in your browser's URL field. Either use the default appliance's IP address or the new one you have set, by typing **https://<IP address>**. By default, ProHD BR-EN900 Ethernet **Port #1** is set to IP address **192.168.1.1,** and Ethernet **Port #2** IP address is provided by a DHCP server.

The login window appears:

Figure 3-3: The Login window

NOTE:

All non-secure "HTTP" prefix URL's will automatically be redirected to the HTTPS URL.

2. Type the password (the default password is **"jvc1234"**) and click the blue arrow. The ProHD BR-EN900 interface is loaded.

Retrieving or Setting Network Parameters through a USB Thumb Drive

To Retrieve Your Network Parameters through a USB Thumb Drive (When ProHD BR-EN900 IP Address is Unknown):

1. Turn ProHD BR-EN900 OFF.
2. Allocate a USB thumb drive, ensure it is empty of any other files and insert it to ProHD BR-EN900 USB port.

NOTE:

USB thumb drive with FAT32 file system must be used.

3. Connect the network cable to ProHD BR-EN900 Ethernet port.
4. Turn ProHD BR-EN900 ON. The network setup file **"EncoderNetworkSettings.txt"** is being copied from the appliance to the thumb drive. Wait a few minutes to ensure that the file is being copied properly.
5. Remove the USB Thumb drive from the appliance, and insert it to a PC.
6. Open the **"EncoderNetworkSettings.txt"** file in the USB thumb drive using any text editor program.
7. Read the IP address from the file.
8. Enter the read IP address in the Internet browser URL field. The Log on window appears.
9. Log in.

To Set Network Parameters through a USB Thumb Drive (When ProHD BR-EN900 IP Address is unknown):

1. Either obtain the **"EncoderNetworkSettings.txt"** from JVC Online Support Portal. This file contains the default IP address of **192.168.1.1.** and open it using any text editor program.

   - or -

   Retrieve the IP address from ProHD BR-EN900 by repeating steps 1 through 9 as described in the section above.

2. Modify any of the listed network parameters, as required, and save the changes.

3. Eject the USB thumb drive properly from the PC and insert it to the ProHD BR-EN900 USB port.

4. Turn ProHD BR-EN900 *ON.* When the boot process is completed, ProHD BR-EN900 will be set with the new IP address.

5. Enter the IP you have set to the Internet browser URL field. The Log on window appears.

6. Log in.

7. Save the file (either on a USB thumb drive or any other place of your choice for future reference. In case ProHD BR-EN900 IP address becomes unknown and needs to be retrieved, this file will be used.

Routing a Unicast Stream through a Specific Ethernet Port

ProHD BR-EN900 automatically routes unicast stream based on its routing table. In case the unicast target address is not directly reachable, and you may wish to route a unicast stream through a specific Ethernet Port, an IP route must be created using the Ethernet configuration over USB key.

To create an IP route:

1. Retrieve the network configuration "EncoderNetworkSettings.txt" from ProHD BR-EN900 as described above.

2. Modify any of the listed network parameters, as required.

3. Modify or add "Ipv4UserRouteTable"/"Ipv6UserRouteTable" sections with the specific routes to be added to the system.

The code to be added is shown below (route 192.168.1.10 to Ethernet Port 1)

```
<Table Name="Ipv4UserRouteTable">
 <Row ID="1">
   <Item Name="Destination" Value="192.168.1.10"/>
   <Item Name="Netmask" Value="255.255.255.0"/>
   <Item Name="Interface" Value="eth0"/>
 </Row>
</Table>
```

4. Turn off the system, copy "EncoderNetworkSettings.txt" to a USB key (FAT formatted), and insert it to the system USB port.

5. Power up the system.

CHAPTER 4

Setup and Operations

In This Chapter

Using the ProHD BR-EN900 Interface

ProHD BR-EN900 Functions

The followings are available at all times (regardless which menu item is selected):

1. **The main menu** - provides a centralized access to monitor, configure and control the ProHD BR-EN900 (see details below).
2. **Dashboard frame** - top of page from which channels are controlled and monitored. The first row represents the HEVC / H.265 channel while the second row represents the MPEG-4 / H.264 channel.
3. **Help** – online help user manual.
4. **Logout** - allows you to log out of the application.

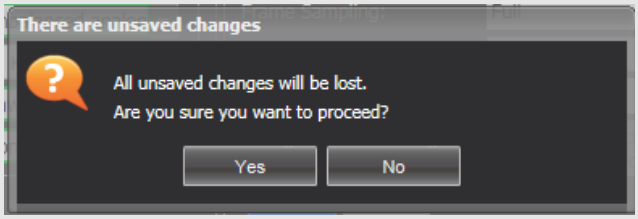
The Main Menu

The ProHD BR-EN900 main menu includes the following items:

- **Dashboard** - view high level channels summary, platform information, network, traffic, and Zixi statistics.
- **Channels** - view and set the following channel parameters: source, processing and target.
- **System** - view and set appliance's parameters such as date and time, network, security, Talkback communication, etc.
- **Event Log** - view system log and events list.
- **Configurations** - allows saving and loading of channel configurations.
- **General** - view system information such as software version, licensing and provides restart, firmware and license upgrade functions.

NOTE:

To accept changes you must click Apply. If you don't click Apply and select another menu item: Dashboard, Channels, System etc., the following warning appears:



The Dashboard Frame

In the dashboard frame section you can control the two encoding channels.

CH	Description
1	HEVC/ H.265 channel – Supports 4:2:0 and 4:2:2 encoding (8/10-bit) up to 1920x1080p, using various streaming protocols.
2	MPEG-4/ H.264 channel – Supports 4:2:0 encoding up to 1920x1080p using various streaming protocols.

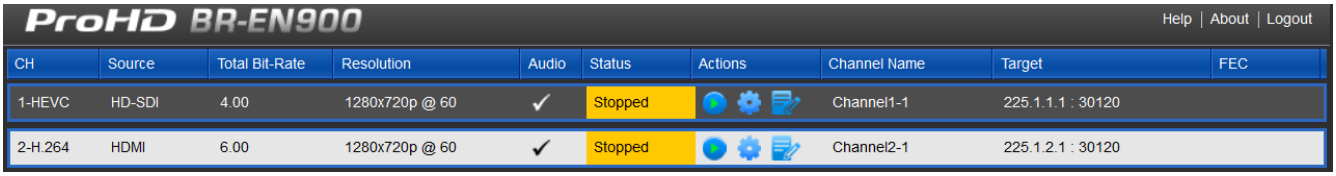
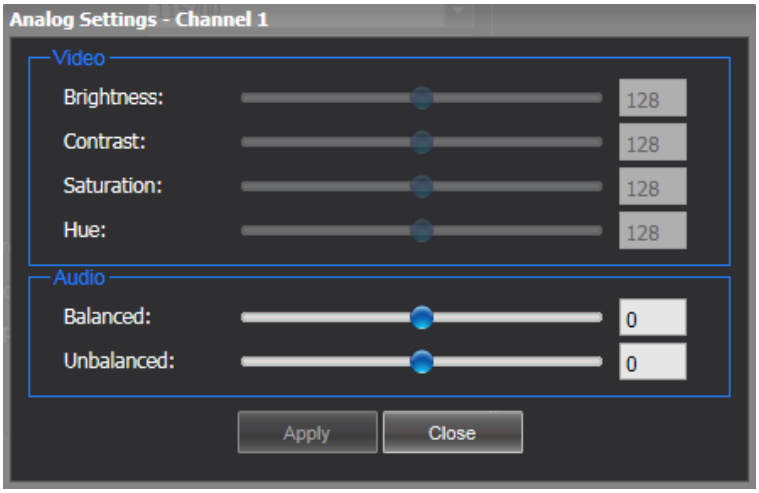


Figure 4-1: The Dashboard Frame

Parameter	Display	Description
CH	1-HEVC 2-H.264	Displays the channel number and the compression format (fixed).
Source	HD-SDI/ HDMI/ DVI/ Composite	Displays the source type assigned to the channel.
Total Bit-Rate	Bit-rate in Mbps	Display the total bit-rate of the channel (Video+Audio +streaming protocol overhead). This value doesn't include additional overhead required when using ProMPEG Forward Error Correction or Zixi™ Error Correction.
Resolution	Video resolution	Displays the encoded (output) video resolution.
Audio		Indicates if audio has been inserted into the stream.
Status	• Playing • Stopped • Error	Displays the status of the channel. Hovering over an "Error" state brings up a tooltip with a description of the error.

		• **Stopped** – **Orange**. The settings for this channel are configured, but the channel has not been activated by the user. • **Playing** – **Green.** The channel is being encoded, and streaming without any known errors. • **Error** – **Red**. The channel has encountered an error. Detailed information can be obtained from the channel's event log.
Control	Play/Stop Analog Settings Event Log	Displays the channel status, allows you to change it and view its related events. **Play/Stop** - allows to start or stop a channel. **Analog Settings -** Brings up a window in which the following Analog Audio/Video parameters can be set on-the-fly: **Audio Gain, Hue, Brightness, Contrast,** and **Saturation** settings are accessible only when an analog source is used.  **Event Log** - provides quick access to the event log of the displayed channel.
Channel Name		Displays the channel name as set by the user.
Target	• Multicast IP • Unicast IP • URL	Displays the target IP address, port number or the URL string.
FEC	Pro-MPEG/ Zixi	Displays the selected error correction technology. Will be left blank when other streaming protocols are used.

The Dashboard Page

The **Dashboard** page is the main page displaying the appliance's view and displays network information for both network interfaces as well as an overall traffic summary.

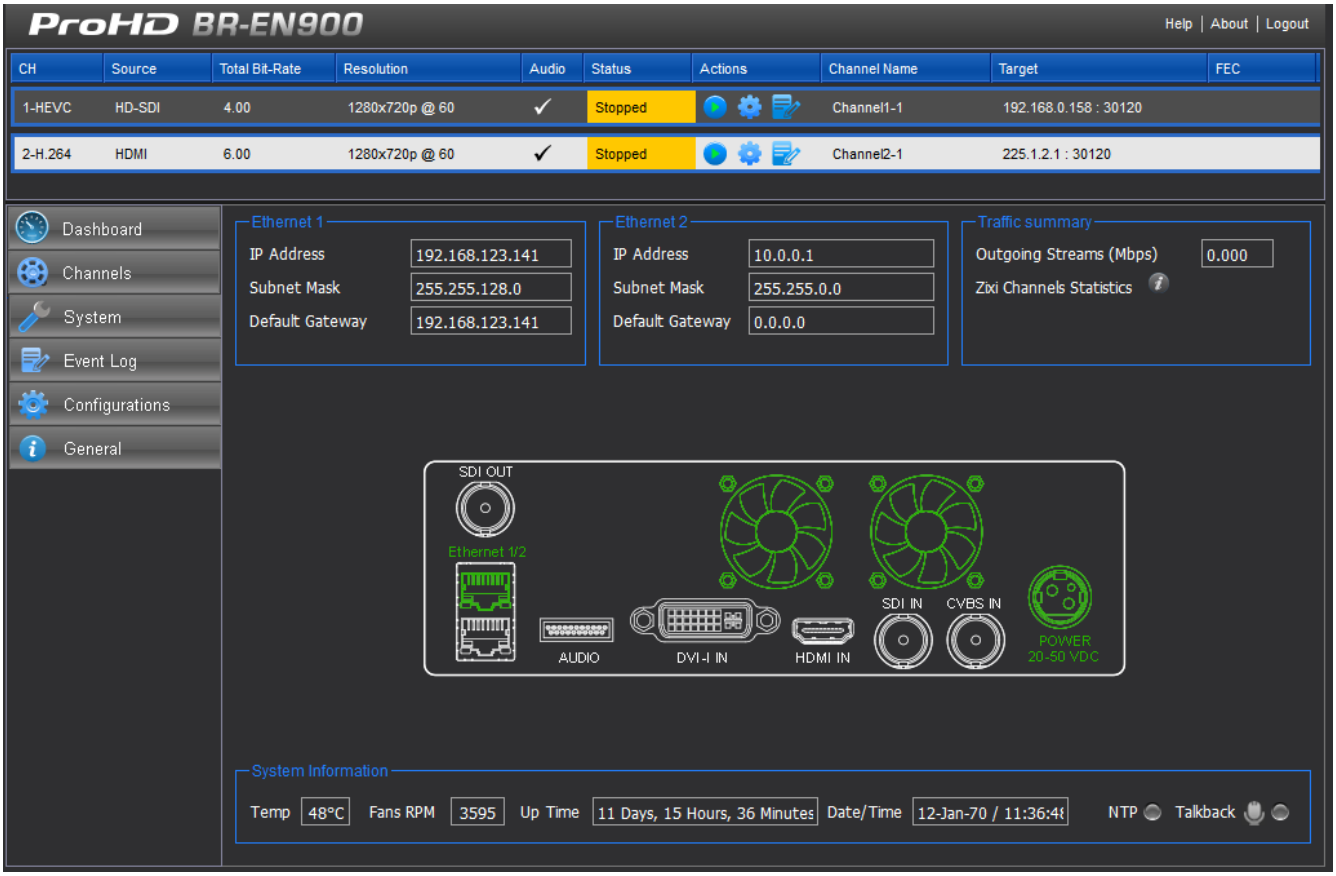


Figure 4-2: The Dashboard page

Interfaces with valid input source appear in green (see figure above).

To view the dashboard parameters:

1. From the main menu, select **Dashboard.** The following parameters are displayed:

NOTE:

The Dashboard page automatically polls the appliance hardware for the latest status of channels, streams and sources every 30 seconds. You may also manually refresh the Dashboard page (by either pressing the "F5" key on your keyboard or re-clicking **Dashboard**), to obtain instantly the current state of the system whenever you configure any of the following parameters: streaming/ management interfaces, traffic, or rear panel connections.

Section	Description
Ethernet 1	IP Address – Displays the Network Interface #1 IP address. Subnet Mask – Displays the Network Interface #1 subnet mask address. Default Gateway – Displays the Network Interface #1 Default Gateway address.
Ethernet 2	IP Address – Displays the Network Interface #2 IP address. Subnet Mask – Displays the Network Interface #2 subnet mask address. Default Gateway – Displays the Network Interface #2 Default Gateway address.
Traffic Summary	Outgoing Streams – Actual stream Bandwidth from both Network Cards. Zixi Channels Statistics - When a Zixi channel is started, the info button provides detailed Zixi statistics information (see **Zixi Statistics Information** section below)
Rear Panel Connectors	Displays the source inputs of the platform. The following is the indications of the source current connection state: Green – connected White – not connected.
System Information	• **Temperature** – Displays the platform's internal temperature in Celsius. The value turns to red when out-of range. • **Fans RPM** – Fan speed (rotation per minute) • **Up Time** – Displays up-time since the last system boot. • **Date/Time** – Display the platform date and time. • **NTP** – An indication LED for status of network time server. Green - Synchronizing with NTP server.

	Red - Not synchronizing with NTP server or the NTP server is unreachable. • **Talkback** – An indication LED for status of talkback communication. **Grey** – Talkback is deactivated **Orange** – Talkback is activated, waiting for a connection **Green**- Talkback communication is established

Zixi Statistics Information

1. When a Zixi channel starts playing, click the info button. The Zixi Channel Statistics window opens:

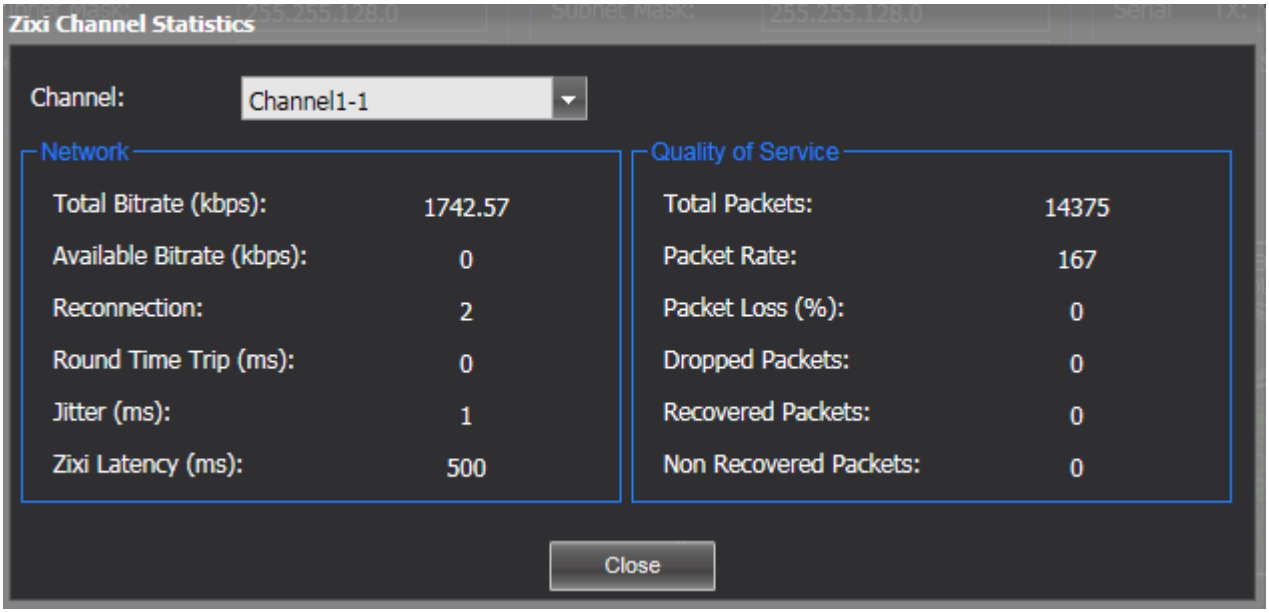


Figure 4-3: The Zixi Channel Statistics window

Parameter	Description
Total Bitrate (kbps)	Current bitrate of the outgoing channel
Available Bandwidth (kbps)	This value is only available when **"Enable ABR (Adaptive Bitrate)"** is enabled (Error correction setting). Current required bandwidth between ProHD BR-EN900 and a Zixi broadcaster or JVC Decoder (ProHD BR-DE900).
Reconnection	Displays the number of reconnection attempts. If this number keeps increasing then the network link is unstable and should be checked.
Round Time Trip (ms)	Two-way delay between the encoder and decoder (RTT).

Jitter (ms)	Network jitter
Latency (ms)	Stream Latency configured on the encoder side. If the latency set is less than 3 times the Round Trip Time (RTT) value, then Latency value turns red to indicate non-sufficient error recovery buffer size (refer to the note below)
Total Packets	Total number of packets already transmitted
Packet Rate	Current number of packets per second transmitted
Packet Loss (p/s)	The current percentage of dropped packets between the encoder and decoder (the packet loss is introduced by the network link). Zixi allows to recover up to 30% packet loss.
Dropped Packets	Total number of packets dropped between the encoder and the decoder due to the network link. The dropped packets are recovered by Zixi technology (see below parameters).
Recovered Packets	The total number of dropped packets that have been recovered on the decoder side since the beginning of the streaming
Non-recoverable Packets	Total number of non-recovered packets since the beginning of the streaming. If the packet loss is lower than 30%, this number should remain to zero, meaning no interruption or decoding artifacts were experienced by the viewer.

Table 4-1: The Zixi Channel Statistics

NOTE:

For getting sufficient error-recovery, it is recommended to set the Zixi Latency (in Channel / Error Correction) at least 3 times larger than the RTT (i.e Latency >= 3* RTT).

The Channels Page

The Channel section provides a one page view dedicated to channel configuration. The configuration is done in three steps:

1. **Source** - select the input video and audio sources to be used for the channel.
2. **Processing** – set the video and audio encoding parameters for the channel as required by the application.

   For easier configuration of the HEVC encoder, a Stream Profile must be selected. For more information see the **Stream Profiles (HEVC)** section below.
3. **Targets** - Define the transport characteristics of the output streams.

Stream Profiles (HEVC):

For easier HEVC channel configuration, the appliance provides a Stream Profile parameter to be set prior configuring the processing section. The profile is linked to a specific application. Based on the Stream Profile selected, ProHD BR-EN900 automatically configures the internal settings of the system to get the best HEVC video quality out of the hardware-based encoder.

- **Broadcast** HQ (default): provides the best video quality streaming without compromise. Latency is not minimized in this mode as B encoded frames are used.
- **Broadcast**: provides best video quality streaming at low bandwidth (typically below 1.5Mbit/s), and drastically optimizes the encoding latency (no B frames possible in this mode). This profile also enables efficient video stream error resiliency without using any error correction technique which would introduce bitrate overhead.
- **Manual** – provides full flexibility to tune the ProHD BR-EN900 to your specific application.

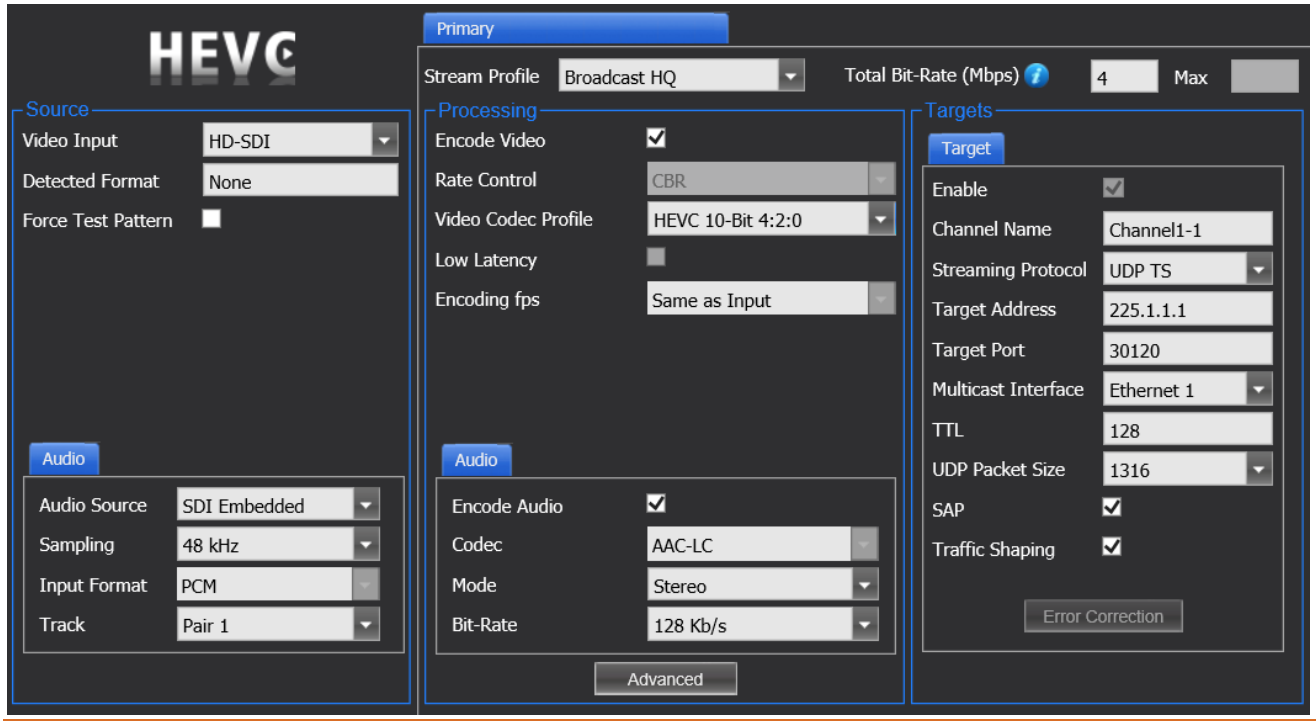


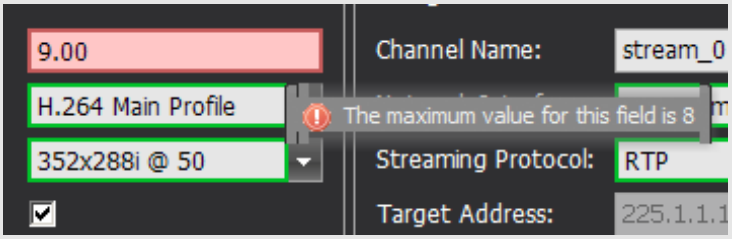
Figure 4-4: The Channels page

To set the channel parameters:

1. From the main menu, select **Channels**.
2. Set the following parameters as required in each section and click **Apply**.

NOTE:

- Fields and optional settings in each one of the sections are automatically adjusted when you switch from HEVC to H.264 channels to display only the settings and the parameters that are applicable to the selected channel.
- A green frame appears when entered value is valid (see figure below).
- A red frame appears when the entered value is not valid accompanied with a message specifying the valid value or a range (see figure below).



- To apply changes to one or more fields you must click the Apply button on the bottom right. When exiting the settings screen or starting a channel without applying the settings, the previous settings will apply.

Source Section

Parameter	Description
Video Input	Select the active source interface. The input source of the H.264 channel always follow the selected source of the HEVC channel.
Detected Format	Displays the detected video format.
Force Test Pattern	Select the box to force a test pattern to be streamed for testing purposes.
Audio Source	Selected the active audio source (available for each of two audio tracks).
Audio Sampling	Select the audio sampling rate (available for each of two audio tracks).
Audio Tracks	Select the embedded audio pair (available for each of two audio tracks).

Processing Section

Parameter	Description
Stream Profile (HEVC only)	Select the Stream Profile to be used for the channel (refer to the **Stream Profiles (HEVC)** section above for detailed information) • **Broadcast** • **Broadcast HQ** • **Manual**
Encode Video	Select the box to enable video encoding.
Rate Control	Select the desired rate control mode as follows: • CBR – constant bit rate. The specified value is used as the total. Audio bit rate, streaming protocol overhead and Metadata bandwidth are deducted from the specified value and the remaining bandwidth is allocated towards the compressed video data. • Capped VBR – variable bit rate with a cap. Average bitrate must be set in the Total Bitrate field. The Max value is used to set a ceiling not to be exceeded by the stream. Bandwidth utilization below the Max is dynamically managed by the encoder based on the complexity of the content, amount of motion and range of colors detected during the session.  CBR is perfectly suited to ensure a constant bandwidth usage over a transmission link. It is highly recommended to use it for satellite/cellular/internet links or any other bandwidth constrained link which requires a constant bitrate. It offers the best compromise of video quality and latency for any video sequence. If short bitrate peaks are allowed on a transmission link (such as LAN), Capped VBR should be used as it offers better video encoding quality and latency than CBR rate control while still providing a constant average bitrate.

Total Bit-Rate	Enter the Total Bit-Rate value in Mbps for CBR mode. Total Bit-Rate and Max in MBps must be filled for Capped VBR. Refer to **Rate Control** above for information about each mode. The Total Bit-Rate value includes the Video / Audio and streaming protocol bitrate. It is possible to review the bitrate allocation using the information button next to the Total Bit-rate value. Bit-Rate can be adjusted "on-the-fly" (without stopping the stream) on both the HEVC and H.264 channel. To adjust automatically the bit-rate based on available bandwidth on the network, use Zixi ABR (Adaptive Bitrate) streaming protocol as detailed in section Error Correction Settings. A Zixi compatible decoder such as BR-DE900 or JVC Zixi zRAMP must be used.
Video Codec Profile	Select the video codec. • For channel 1 select any of the HEVC/ H.265 available profiles. • For channel 2 select any of the H.264 available profiles. For HEVC channel it is recommended to use 10-Bit encoding in any application for best video quality results. 8-Bit encoding is provided to ensure compatibility with 8-Bit only decoders.
Low Latency (HEVC only)	Select this box to ensure optimized HEVC encoding latency. To get best glass to glass latency, it is recommended to use JVC decoder: BR-DE900 or JVC zRAMP. Low latency mode is not available when B frames are used (not available in Broadcast Profile).
Encoding fps	Select the encoding frame rate
Encode Audio	Select the box to activate audio encoding.
Codec	Select the audio codec.
Audio Mode	Select the box to enable audio choices (Stereo, Mono Right or Mono Left). Available for each audio track.
Audio Bit-Rate	Select the audio encoding bitrate. Available for each audio track.
Advanced	Click it to access the Advanced Settings window (see below).

Advanced Settings – HEVC

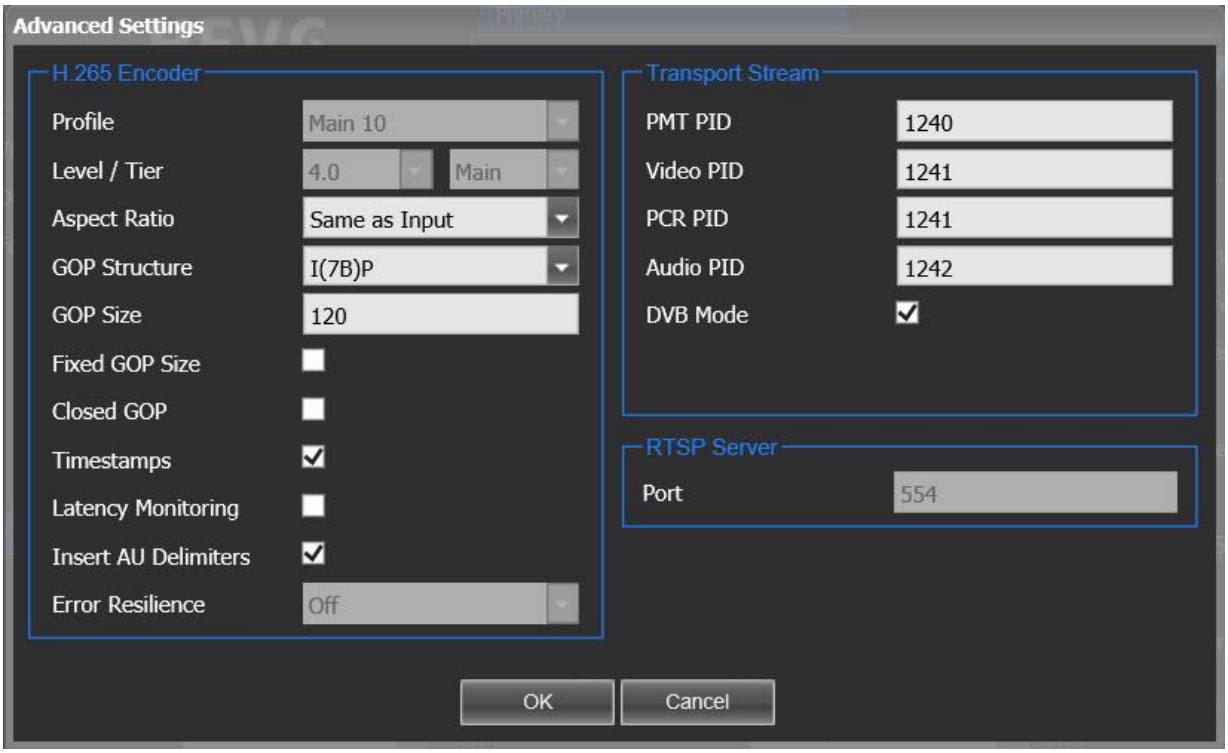


Figure 4-5: The Advanced Settings - HEVC window

By default, many of the advanced parameters are determined automatically by the system's internal algorithm and are based on the selected profile, resolution, compression format and bit-rate. However, for certain applications and for unique scenarios you may be able to optimize video quality, latency, and overall behavior of the codec, by manually modifying some of the advanced settings fields. Modifying these advanced settings may also lead to degraded video quality and/or performance in case selected values are not ideal for the targeted application.

Contact JVC Support Team, to confirm the appropriate settings for an application.

- **Profile / Level / Tier –** Profile, Level and Tier used by the encoder. It is automatically calculated based on the encoding resolution, framerate, bitrate, bit depth and color sampling. The encoder supports the below Profile/Level/Tier:
  - **Profile:** Main, Main10 and Main 4:2:2 10
  - **Level:** up to level 5.2
  - **Tier:** Main / High

- **Aspect Ratio –** The proportional relationship between the video width and its height. For auto configuration "Same as Input" shall be set.
- **GOP Structure –** Specifies the GOP structure used by the encoder. The encoder supports:
  - Intra Frame encoding
  - IP: IP encoding is recommended for applications sensitive to latency. Alternatively, IB structure below could be used.
  - IB: It is recommended to use IB structure instead of IP if the decoder is compatible with such mode. The efficiency of B frames is higher than P frames leading to a better compression ratio while keeping a low latency.
  - IBBBP: This structure is recommended to ensure the best video quality / compression ratio at the cost of higher latency.
  - I(7B)P equivalent to IBBBBBBBP: This structure is recommended to ensure pristine video quality / compression ratio at the cost of twice more latency than IBBBP structure.
- **GOP Size** – The intervals between I-Frames. Range is 1-300. A default and optimal value is calculated based on the profile selected and the encoding frame rate.
- **Fixed GOP Size** – If enabled, it ensures GOP structure is not modified during the encoding process. Fixed GOP Size might be necessary for compatibility with sensitive decoder. When enabled, it impacts negatively the compression efficiency.
- **Closed GOP** – The I-Frame does not contain information from previous GOPs. Select the box to close each GOP with an I-Frame. When enabled, it impacts negatively the compression efficiency.
- **Timestamps** – Enable to insert Timecode information within the video stream. If VITC is available within the SDI input, it is used as default Timecode value. If not present or another video input is used, time of the system is inserted.
- **Latency Monitoring** – Enable to allow end-to-end latency monitoring when decoding the stream with BR-DE900. Latency can be monitored within BR-DE900 web interface or via HTTP command.

  If enabled, Timecode input is not captured from SDI input anymore.

- To ensure accurate Latency Monitoring, system date must be synchronized to an NTP server. Ensure to correctly configure the NTP server in System/Date and Time section on both ProHD BR-EN900 and BR-DE900.
- When Latency Monitoring is enabled, SDI timecode (VITC) is no more embedded.

- **Insert AU Delimiters** - Select the box to enable Access Unit Delimiter in the NAL (Network Abstraction Layer) unit of the HEVC frames.
- **Error Resilience** – This setting defines HEVC encoder strategy to protect the stream from being heavily corrupted at the decoder output when an error occurs in the transmission link (Packet loss, Packet Corruption,…). Three steps are available: Off / Medium /High.

  This mode can be used when error correction at the transport level (Zixi or Pro-MPEG) cannot be activated due to latency concerns.

- **PMT PID** – A special identifier of the PMT within the transport stream. The PMT (Program Mapping Table) describes the various services and their PIDs within the transport stream. Default: 1240.
- **Video PID** – A unique identifier of the video service within the transport stream. Only a single video service is available per a transport stream. Default: 1241.
- **PCR PID** – A special identifier of the PCR data within the transport stream. The PCR (Program Clock Reference) data contains clocking information for synchronization between various services. Default: 1241.
- **Audio PID 1** – A unique identifier of the first audio service within the stream. Up to two Audio services can be available per a transport stream. Default: 1242.
- **DVB Mode** – Select this check box to comply with DVB standard. At low bitrate (<1Mbps), enabling DVB mode may result in an increased bitrate.

  This parameter is then disabled in "ISR – Low Bandwidth" profile.
- **RTSP** - Server Port – RTSP Server port (default is 554)

Advanced Settings – H.264

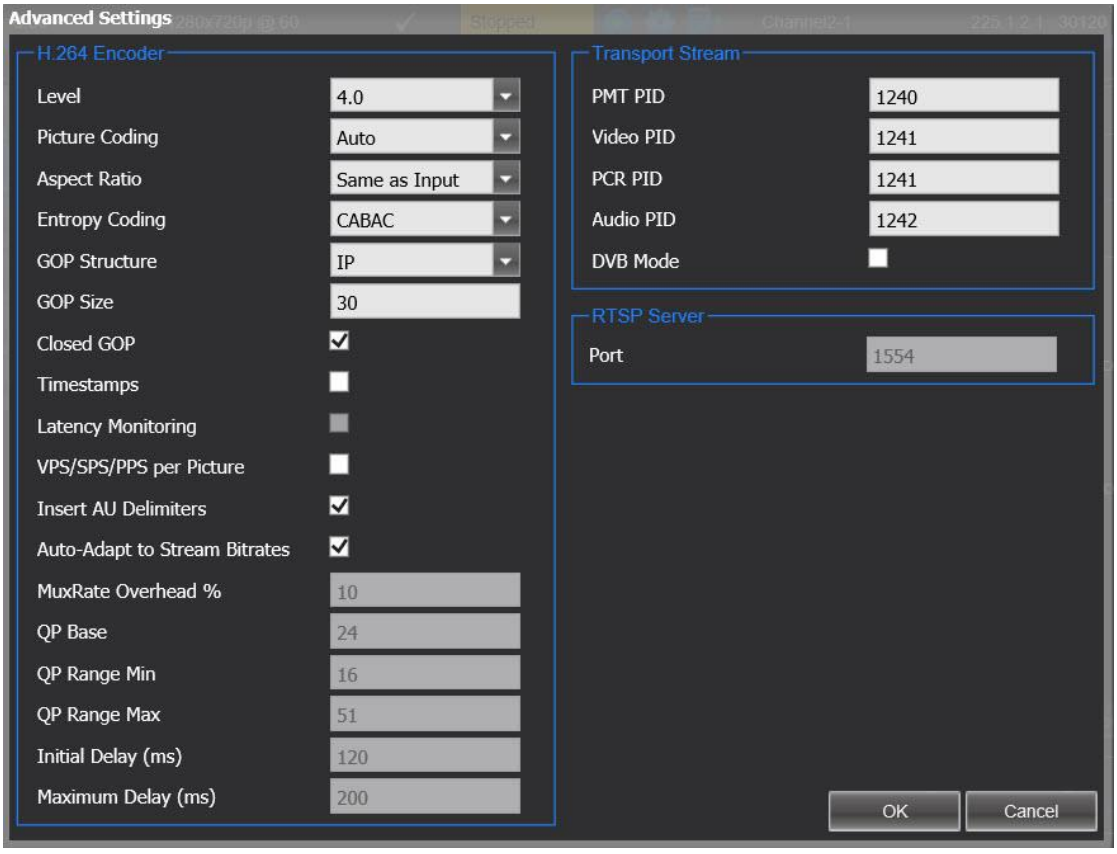


Figure 4-6: The Advanced Processing - H.264 window

Use the manual settings option cautiously. Incompatible combination of parameters that were manually set, may result in a video and audio quality degradation. Consult with JVC Support Team for recommendation on specific settings if you wish to optimize the compression and streaming settings for a specific application.

- **Level** - The encoding level of the HEVC/H.264 codec. Choices are 3.0, 3.1, 3.2, 4.0 (default), 4.1, 5.0.
- **Picture Coding** - Determines how picture is compressed. Choices are Auto, Frame Only, Field Only, MBAFF and PAFF.
- **Aspect Ratio** – The proportional relationship between the video width and its height. For auto configuration select "Same as Input".
- **VLC Mode** – The Variable Length Coding is a code that maps source symbols to a variable number of bits. Variable-length codes can allow sources to be compressed and decompressed with zero error (lossless data compression) and still be read back symbol by symbol. Choices are: CABAC (context-based adaptive binary arithmetic coding), or CAVLC (Context-adaptive variable-length coding).
- **GOP Structure** - Specifies the order in which I, P, and B frames are arranged in the video stream. GOP (Group of Pictures) choices are: IP (default), I, IBP, IBBP.

  Compression settings may impact video latency. Using B-Frames will improve the quality of the compression, achieving better quality at a given bitrate. However, usage of B-frame will increase latency. To achieve the lowest end-to-end latency, disable B-Frames and use GOP structures with 'I' and 'P' frames only. When B-Frames are not in use, you may decrease the buffer size of your decoder (when configurable in the video decoder settings), to benefit from lower latency without impacting the viewing quality.

- **GOP Size** – The intervals between I-Frames. Range is 2-300 (default is 30).
- **Closed GOP** – The I-Frames do not contain information from previous GOPs. Select the box to close each GOP with an I-Frame.
- **Timestamp** – Enable to insert Timecode information within the video stream. If VITC is available within the SDI input, it is used as the default Timecode value. If not present or another video input is used, insert the system time.
- **Latency Monitoring** – Enable to allow end-to-end latency monitoring when decoding the stream with BR-DE900. Latency can be monitored within BR-DE900 web interface or via HTTP command.

  If enabled, Timecode input is not captured from SDI input anymore.

  - To ensure accurate Latency Monitoring, system date must be synchonized to an NTP server. Ensure to correctly configure the NTP server in System/Date and Time section on both ProHD BR-EN900 and BR-DE900.
  - When Latency Monitoring is enabled, SDI timecode (VITC) is no more embedded.

- **VPS/SPS/PPS per Picture** - Select the box to enable Video Parameter Set (VPS), Sequence Parameter Set (SPS), and Picture Parameter Set (PPS) within the NAL (Network Abstraction Layer) of every picture. When the box is clear SPS and PPS will appear only in I-Frames.

- **Insert AU Delimiters** - Select the box to enable Access Unit Delimiter in the NAL (Network Abstraction Layer) unit of the H.264 frames.
- **Auto-Adapt to Stream Bitrates** - Select the box to allow the encoder to automatically optimize advanced compression and streaming parameters to the bit-rate you defined for the channel.
- **MuxRate Overhead %** - The average amount of null packets relative to the total bitrate while streaming CBR. The default value (10) is designed for reaching the best video quality in typical content. However, this parameter can be changed to achieve the best quality in some other contents. Enter the allocated percentage of the stream for the multiplexer (range is 5-1000, default is 10).
- **QP Base** - The initial quantization (compression) level value used (range is 1-51, default is 24).
- **QP Range Min** - Minimum quantization (compression) value (range is 1-51, default is 16). When a minimum value is set, the encoder will not use a lower value than specified. This setting is mainly relevant for content with minimal movement where bit rate allocation can be reduced.
- **QP Range Max** - Maximum quantization (compression) value (range is 1-51, default is 44). When a maximum value is set, the encoder will not use a higher value than specified. This setting is specifically relevant in motion-intensive scenes where higher bit rate allocation is needed.
- **Initial Delay (ms)** - The delay for incoming PTS/DTS relative to PCR (range is 50-500, default is 96). This setting enables the control of buffering within the receiver / decoder.
- **Maximum Delay** - Maximum duration threshold before Access Units (AU's) are multiplexed together. This setting minimizes high bitrate variations (range is 1-1000, default is 192).
- **PMT PID** – A special identifier of the PMT within the transport stream. The PMT (Program Mapping Table) describes the various services and their PIDs within the transport stream. Default: 1240.
- **Video PID** – A unique identifier of the video service within the transport stream. Only a single video service is available per a transport stream. Default: 1241.
- **PCR PID** – A special identifier of the PCR data within the transport stream. The PCR (Program Clock Reference) data contains clocking information for synchronization between various services. Default: 1241.
- **Audio 1 PID** – A unique identifier of the audio service within the transport stream. Up to two Audio services can be available per a transport stream. Default: 1242.
- **DVB Mode** – Select this check box to comply with DVB standard. At a low bitrate (<1Mbps), enabling DVB mode may result in an increased bitrate.
- **RTSP** - Server Port – RTSP Server port (default is 554)

Target Section

Parameter	Description
Channel Name	Enter the channel name. This name will also appear in Session Announcement Protocol (SAP) messages.
Streaming Protocol	Select the streaming protocol.
Target Address	Enter the target IP address.
Target port	Enter the target port.
Multicast Interface	Select the network interface to stream from while using a multicast target address. In case, a unicast stream requires to be routed through a specific Ethernet Port, refer to the Note below.
TTL	Enter the TTL value Time-to-live (TTL) tells a network router whether the packet has been in the network too long and should be discarded. Each time an IP packet hits a router, TTL value is reduced by 1. If TTL remains greater than 0, the router forwards the packet, otherwise it is discarded. Set a value high enough to ensure streaming packets are reaching the decoder. TTL value can be found by pinging the remote decoder. The Value range is 1-255.
UDP Packet Size	Enter the UDP packet size value. Some transmission link accepts only smaller UDP packet size. Reduce the UDP packet size if experiencing decoding problems.
SAP	Select the SAP check box to enable Session Announcement Protocol.
Traffic Shaping	Select the Traffic Shaping check box to enable network smoothing.
Error Correction Settings	Available with Zixi™ and Pro-MPEG mode. See details below.
CDN Settings	Available for RTMP mode (H.264). See details below.

NOTE:

You must click **Apply** for the new settings to be saved.

NOTE:

When a video source is lost or different format is selected while the channel is playing, a color bar is displayed. In such case verify the following:

- A source is connected
- The video frame rate and/or resolution match the one selected for the channel.

NOTE: Routing a unicast stream through a specific Ethernet Port

ProHD BR-EN900 automatically routes unicast stream based on its routing table. In case the unicast target address is not directly reachable, an IP route must be created using the Ethernet configuration over USB key.

To create an IP route:

1. Retrieve the network configuration "EncoderNetworkSettings.txt" from ProHD BR-EN900 as described in "Retrieving or Setting Network Parameters through a USB Thumb Drive" section
2. Modify any of the listed network parameters, as required.
3. Modify or add "Ipv4UserRouteTable"/"Ipv6UserRouteTable" sections with the specific routes to be added to the system.

   The code to be added is shown below (route 192.168.1.10 to ETherent Port 1)

```
<Table Name="Ipv4UserRouteTable">
 <Row ID="1">
   <Item Name="Destination" Value="192.168.1.10"/>
   <Item Name="Netmask" Value="255.255.255.0"/>
   <Item Name="Interface" Value="eth0"/>
 </Row>
</Table>
```

4. System powered off, copy "EncoderNetworkSettings.txt" to a USB key (FAT formatted) and insert it to the system USB port.
5. Power up the system.
6. When the boot process completes, and the LED is steady-green, the system is set with the new IP address/Route parameters.

Error Correction Settings

Zixi™

The Zixi protocol supports two modes: Zixi Broadcaster Server and Point-to-point streaming directly from the JVC encoder to the JVC decoder appliance. Zixi sessions can be protected by a password. Protected sessions ensure that only authorized encoders/decoders participate in these sessions.

- **Password**: If a password was set on Zixi™ server, enter the password for streaming. If no password was set on the Zixi™ server, no password is required. When connecting directly (point-to-point) to a decoder, a password is not applicable.
- **Latency:** Enter a latency value in milliseconds to be used for correcting errors. The minimal latency to be used must be higher than 3 times the RTT value (Round Trip Time) between the encoder and the targeted decoder. RTT value is available in Zixi Channel Statistics window after the Zixi channel has been started. Additionally, higher latency increases tolerance to network errors (range 0-6000 milliseconds). The actual error correction rates depend also on the stream bit-rate. On average, 500ms latency yields protection of up to 6% of network errors. 6000ms latency yields protection of up to 30% of network errors.

- When using a Zixi latency lower than 500ms, FEC data protection is enabled resulting in an increased total output bitrate up to 50%. Ensure the transmission link bandwidth is dimensioned for such bitrate.
- If Zixi latency is set to 0, no data protection is achieved. Use this value to analyze the quality of your transmission link. Transmission link statistics are reported within the Zixi Statistics Channel (Dashboard).

  Check the Zixi Statistic information window to monitor the packet loss of the transmission link used and set the latency accordingly.
- **Enable ABR (Adaptive Bitrate)**: Select the check box to allow either JVC decoder or Broadcaster Server to automatically change the encoding bit-rate while streaming. When selected, the channel total bit-rate will automatically be optimized, based on network performance and statistics from the Zixi stream recipient, to ensure smooth, artifacts-free playback.
  - Minimum Bit-Rate: Set the minimum bit-rate allowed while in dynamic mode
  - Maximum Bit-Rate: Set the maximum bit-rate allowed while in dynamic mode.

- **Enable Failover**: Select the check box to allow ProHD BR-EN900 to switch over a secondary Zixi target when the primary one is no more reachable.
  - Set the IP address of the Zixi failover target
  - Set the Port address of the Zixi failover target.

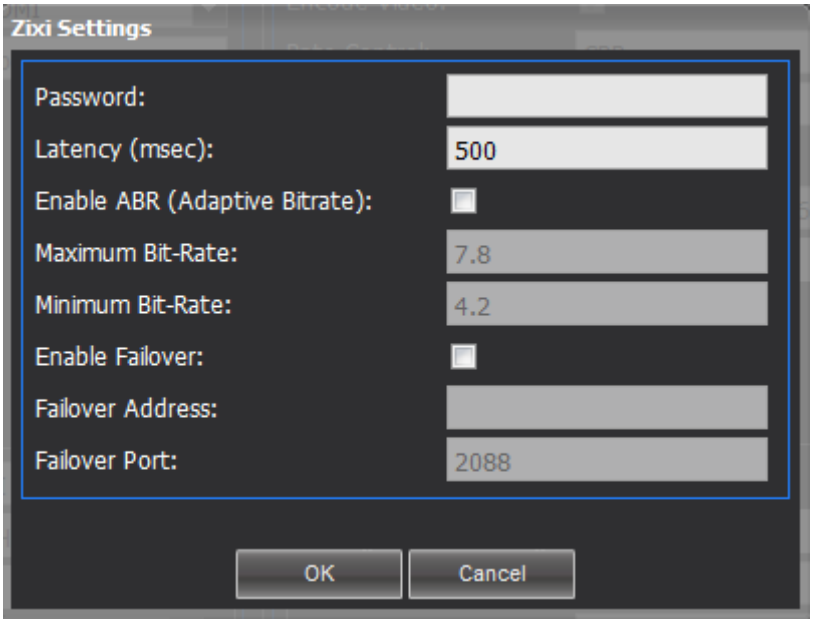


Figure 4-7: The Zixi Settings window

Pro-MPEG Forward Error Correction (SMPTE-2022)

When FEC is implemented, the encoder sends additional data to enable the reconstruction of lost data, regardless if needed or not. The performance of the FEC is always a tradeoff between latency, overhead and error correction capabilities. FECs with large dimensions, e.g. 20x5, 10x10 provide less overhead (between +5% and +20%), but have larger latency and better correction capabilities compared to FEC tables with smaller dimensions.

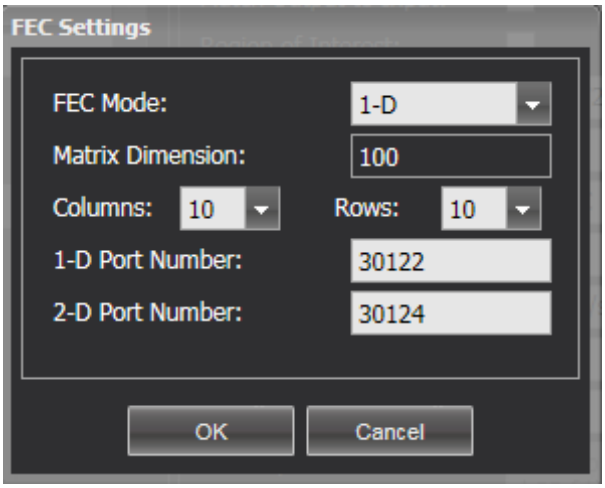
FEC induces additional latency in the transmission. If a FEC packet matrix of 20x5 is chosen, it adds 260 milliseconds latency. Smaller sized FEC packet matrixes and transmissions with higher bitrates will add less delay.

Overhead in data rate, added by 2D-FEC, can be calculated by following formula:

$$2D\text{-}FEC\ Overhead\ in\ \% = \frac{(rows + columns)}{(rows * columns)} * 100\%$$

Overhead in data rate, added by 1D-FEC, can be calculated by following formula:

$$1D\text{-}FEC\ Overhead\ in\ \% = \frac{1}{rows} * 100\%$$



- **FEC Mode**: Select the **Forward Error Correction** dimension mode: **1-D** (only the column checksums will be sent to the destination), or **2-D** (checksums of both columns and rows will be sent to the destination).
- **Matrix Dimension:** The specified FEC rows and FEC Columns from which row checksums and column checksums will be generated (FEC algorithm = XOR)**.** Displays the columns/rows multiplying value of the column/rows. Matrix size value must be less than 100.
- **Columns/Rows:** Select the desired values for the selected FEC. For the column, value can range from 1 to 20.
- **1-D Port Number:** Enter the port number from through columns checksums will be sent.
- **2-D Port Number:** Enter the port number from through rows checksums will be sent when 2-D mode is selected.

The network bandwidth overhead for Pro-MPEG technology is fixed, and is determined by the XOR matrix dimensions and size selected values. Bandwidth overhead exists regardless of whether the network link has errors or not.

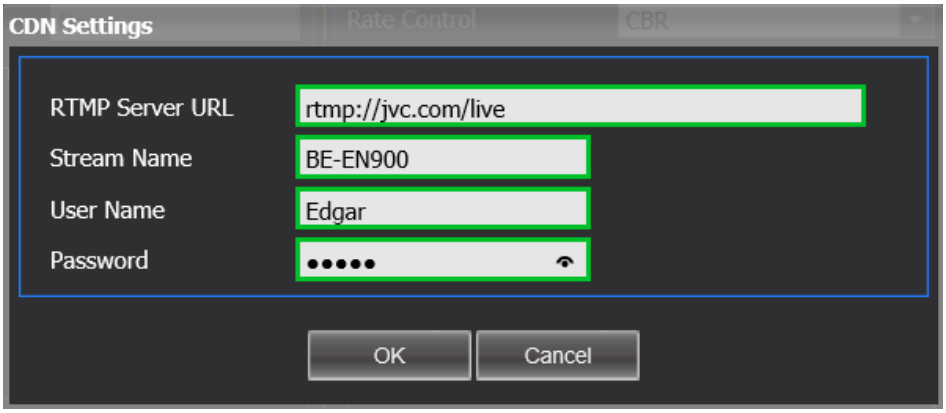
RTMP Settings

The RTMP protocol allows streaming video and audio content to a wide range of Content Delivery Network (CDN) providers such as Akamai, Limelight, YouTube or based on Adobe Media Servers (AMS) or Wowza servers.

RTMP protocol, used in conjunction with a CDN, is recommended to reach a large audience on the public internet. RTMP is available for the H.264 channel.

RTMP streams can be protected by a password.

The RTMP protocol that streams from ProHD BR-EN900 has passed Akamai certification and has been validated against Limelight, YouTube CDNs as well as on Adobe Media (AMS) and Wowza Servers.



- **RTMP Server URL**: Enter the URL of the target RTMP server.
  You may use one of the following syntaxes:
  - rtmp://IP_ADDRESS/xxxx
  - IP_ADDRESS/xxxx

- If using a domain name for the URL (for example **"rtmp:/JVC.live/stream"**), ensure that the DNS information is properly set in the **System>Network Interfaces** page (**DNS1** and **DNS2** fields).
- The DNS server is mandatory to resolve the domain name IP address.

- **Stream Name**: Enter the stream name that was either set or provided in/by your CDN account for the RTMP stream.
- **User Name**: Enter the User Name from your CDN account for the RTMP stream.
- **Password**: Enter the password that was set in your CDN account for the RTMP stream. If no password was set on the CDN server, no password is required.

The System Page

In the **System** page you set the parameters of the following tabs:

- **Network Interfaces (Ethernet Port #1** and **#2)**
- **Security**
- **Date and Time**
- **SAP**
- **IFB/Talkback**

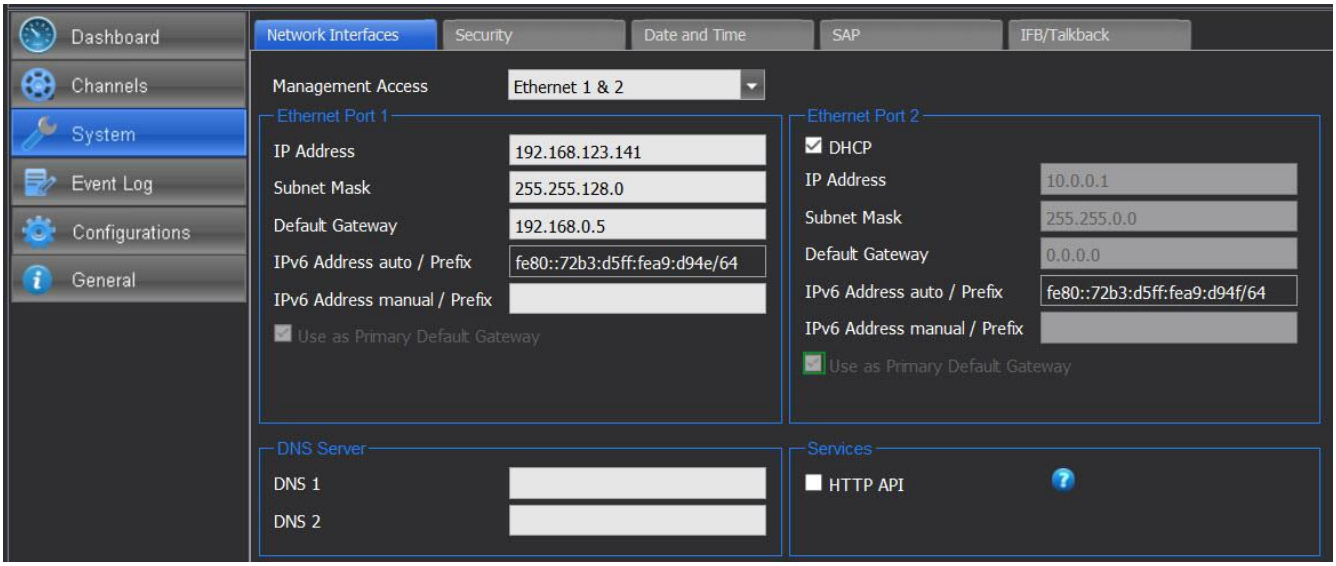


Figure 4-8: The System page

To set the system parameters:

1. From the main menu select **System.**
2. Set the desired parameters as required in each section and click **Apply.**

To set the network interface (see figure above):

Two network interfaces are available. Each one can be used for either management and/or streaming. For easier management of the system, Ethernet Port 2 can be configured in DHCP mode. If DHCP mode is selected, Ethernet Port 2 will obtain the IP address automatically from the DHCP server and the DNS server will also be populated automatically.

Parameter	Description
Management Access	Select the Ethernet Port used for management (Ethernet Port 1, 2 or 1&2)
IP Address/IPv6 Address/Prefix	Enter a static IP address and a prefix address in case IPv6 is used.
Subnet Mask	Enter the subnet mask address.
Default Gateway	Enter the gateway address
DHCP (Ethernet Port 2)	Select this box to enable automatic retrieval of IP address and DNS server information from the DHCP server.
DNS1	Optional field - required if a domain name is used instead of an IP address (RTMP protocol).
DNS2	Optional field - required if a domain name is used instead of an IP address (RTMP protocol).

To control ProHD BR-EN900 over HTTPS API:

Select "Enable HTTP API" check box to enable system control and status over the HTTPS REST API.

The API documentation can be accessed through the question mark link.

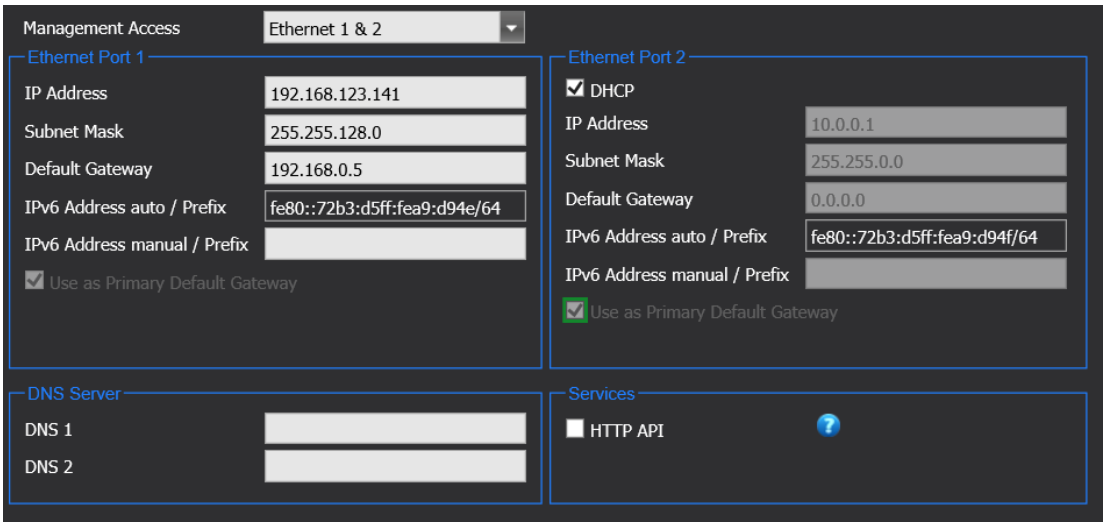


Figure 4-9: The Network Interface tab

NOTE:

- The API documentation is directly available from the ProHD BR-EN900 web page.
- Click the info button next to "**HTTP API**" to load the API information page.

To set Security:

Parameter	Description
Current Password	Type the current password.
New Password	Type the new password (8-14 characters).
Re-Type Password	Re-type the new password.
Host Name	The default is **BR-EN900<xxxx>** (where the last four digits are the platform serial number). The host name can be changed only through SSH client. See Initial Connection and Setup for detailed instructions

To set Date and Time:

Parameter	Description
Use NTP	Select the box to enable synchronization with the NTP server. If using an NTP server located on the Internet, ensure the DNS server address is correctly set (Network Interface tab).
Server Address	Enter the NTP server address.
Sync Period	Enter the synchronization period.
Date	Set the date.
Time	Set the time.
Time Zone	Set the time zone.
Daylight Saving	Select the **Enable** box and set the start date and time for Daylight Saving.

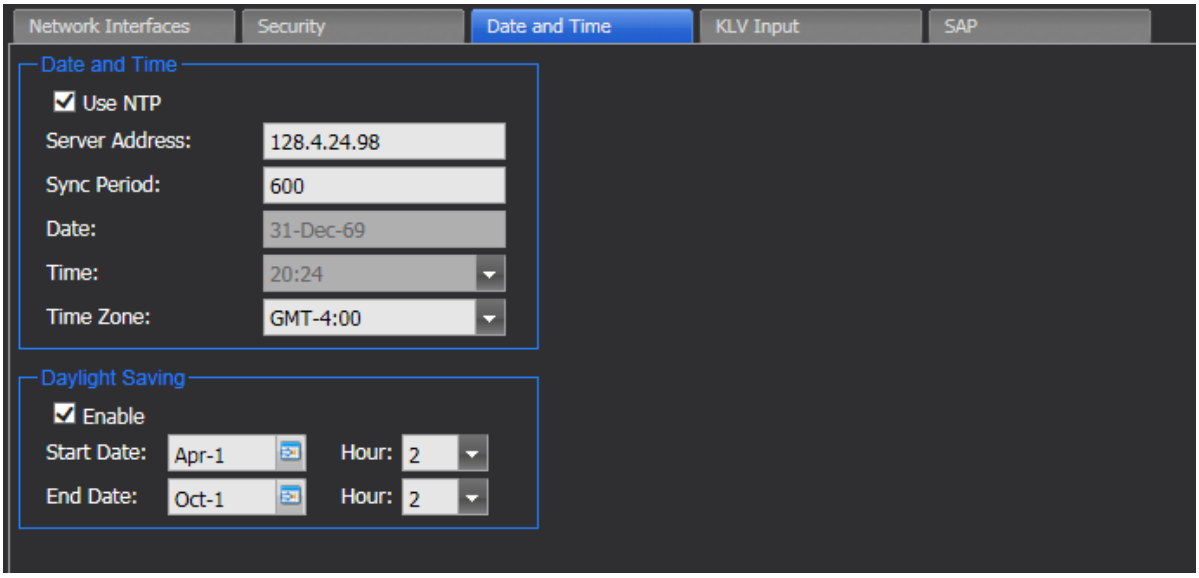


Figure 4-10: System Page - Date and Time screen

NOTE: Latency Monitoring feature and NTP

- For reliable Latency Monitoring, ensure NTP is configured properly and connected to the NTP server
- The Dashboard window indicates if NTP connection is running

To set SAP:

Parameter	Description
Use default SAP address and port	Use the default Session Announcement Protocol multicast group and port as per RFC 2974.
IP Address	Set the target multicast IP address to which SAP messages will be sent.
Port	Set the target port to which SAP messages will be sent.
Announcement Interval (sec)	Set the interval between SAP messages.

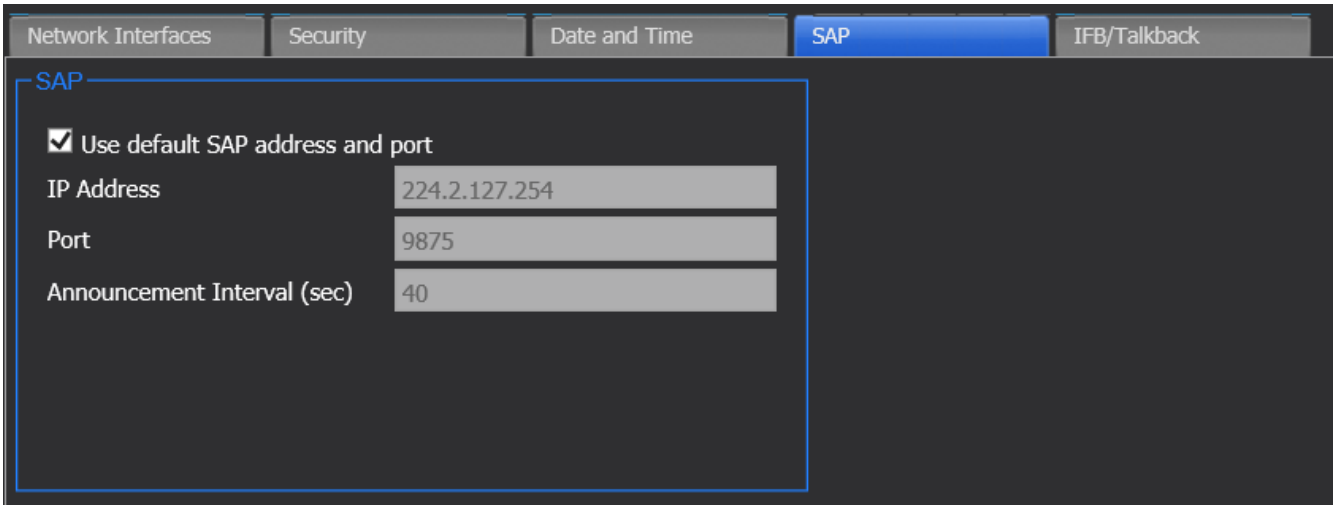


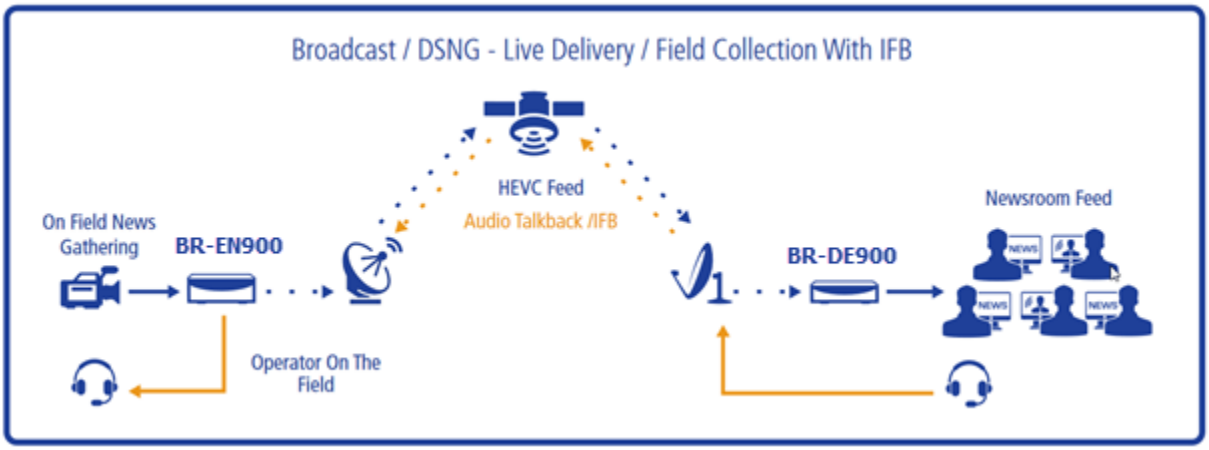
Figure 4-11: The SAP screen

NOTE:

You must click **Apply** for the new settings to be saved.

To configure Talkback/IFB communication with BR-DE900:

IFB/Talkback feature provides an easy communication path between remote teams. For example, using ProHD BR-EN900 and BR-DE900 pair, operator on the field (encoder side) can easily receive/provide feedback from/to the newsroom (Broadcast application).

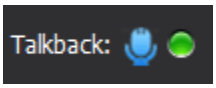


When using the talkback feature, ProHD BR-EN900 can output the received audio over a line level unbalanced analog audio output (TALKBACK connector available on the breakout cable).

Two-way audio communication is also possible and ProHD BR-EN900 can either transmits the encoded HEVC Audio 1 or 2 or the Unbalanced Analog Audio Input (ANALOG AUDIO 2 connector available on the breakout cable – line level).

NOTE:

ProHD BR-DE900 must be used to establish a talkback session with ProHD BR-EN900.

Parameter	Description
Talkback Mode	Set the talkback mode: • OFF • Manual: the talkback session is OFF but can be activated in the dashboard page using the Talkback MIC icon.  Once pressed, the unit attempts to connect to the remote receiver for 30 seconds. The talkback session can be stopped clicking the MIC icon. In this mode, if the session is dropped, ProHD BR-EN900 does not try to reconnect automatically. • Auto: The talkback session can be started and stopped as detailed above. In this mode, if the session is dropped, ProHD BR-EN900 does try to reconnect automatically.
Target IP Address	Set the talkback receiver IP Address
Target Port	Set the talkback receiver Port
Speaker Audio Output Gain	Set the audio level output gain
Audio Input Source	Set the audio input source used for the talkback session
Audio Input Gain	Set the audio level input gain

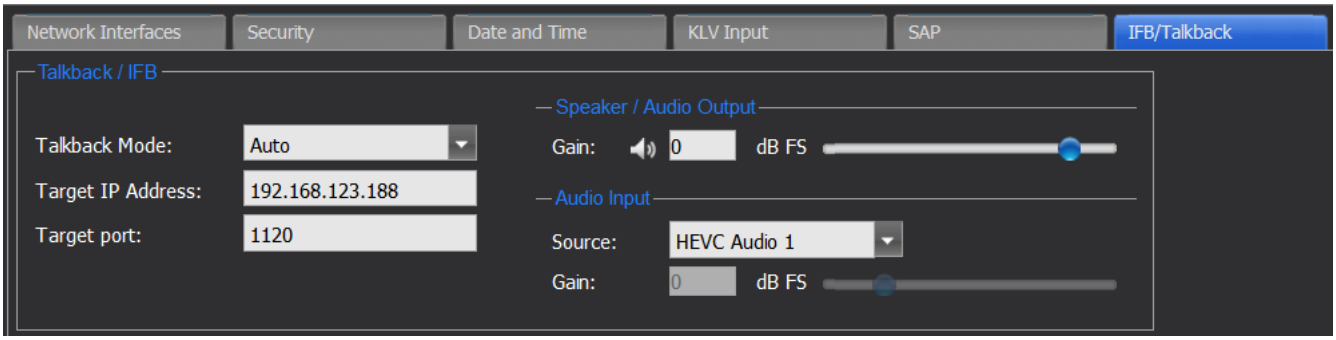


Figure 4-12: The Talkback/IFB screen

NOTE:

You must click **Apply** for the new settings to be saved.

The Event Log Page

In the **Event Log** page you can view the log of events and export them.

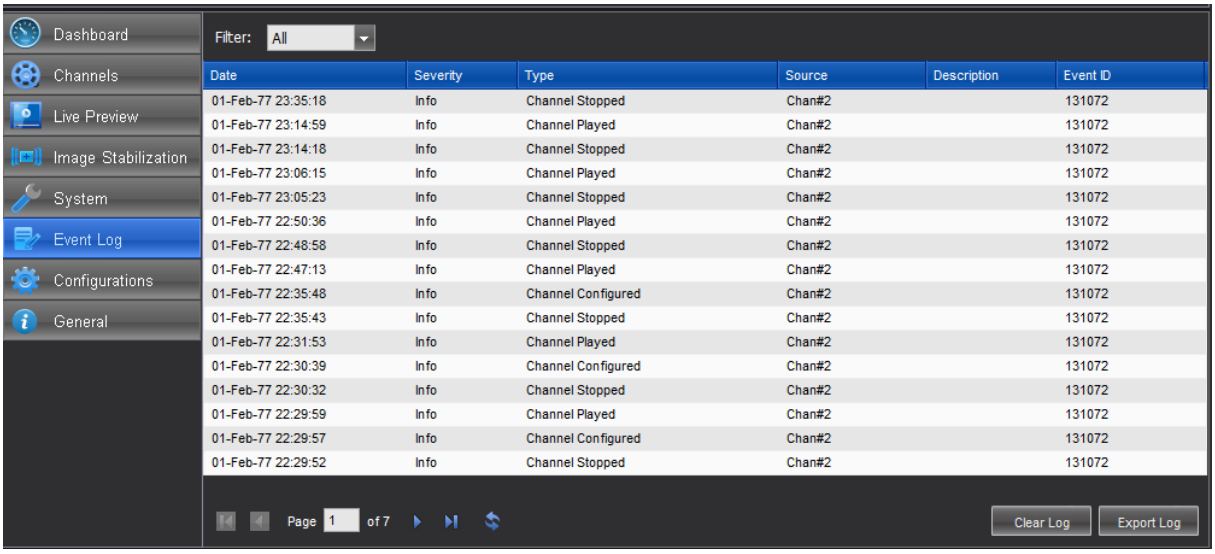
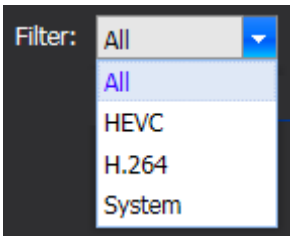


Figure 4-13: The Event Log page

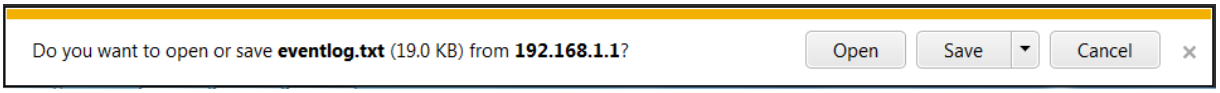
To filter the view:

1. From the **Filter** drop-down list select one of the following options:



To export event log:

1. Click **Export Log.** The **File Download** window appears.



1. Click **Open** to open the log. The log file is opened with a common text editor (such as notepad)

   - *Or* -

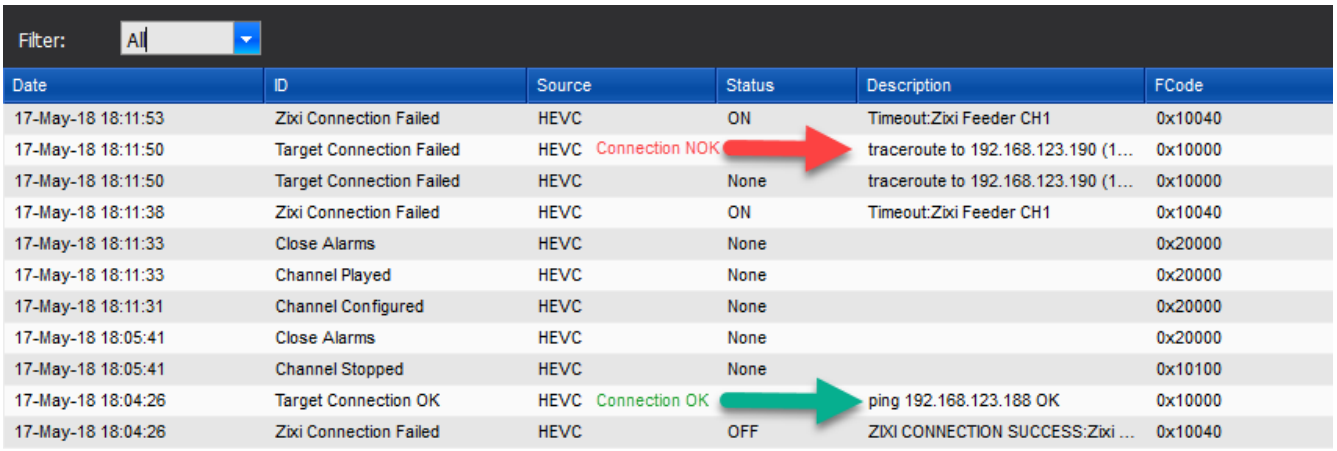
2. Click **Save** to save the file.

To verify connection status between encoder and decoder:

When unicast streaming is used, ProHD BR-EN900 automatically tests the accessibility to the target IP address set by the user.

- If connection is established, the event reports "Target Connection OK"
- If connection cannot be established, the event reports "Target Connection Failed" and ProHD BR-EN900 displays the IP packets route. It allows identifying the remote node where IP traffic is stopped.

Below is an example of successful and failed connections:



Date	ID	Source	Status	Description	FCode
17-May-18 18:11:53	Zixi Connection Failed	HEVC	ON	Timeout:Zixi Feeder CH1	0x10040
17-May-18 18:11:50	Target Connection Failed	HEVC	None	traceroute to 192.168.123.190 (1...	0x10000
17-May-18 18:11:50	Target Connection Failed	HEVC	None	traceroute to 192.168.123.190 (1...	0x10000
17-May-18 18:11:38	Zixi Connection Failed	HEVC	ON	Timeout:Zixi Feeder CH1	0x10040
17-May-18 18:11:33	Close Alarms	HEVC	None		0x20000
17-May-18 18:11:33	Channel Played	HEVC	None		0x20000
17-May-18 18:11:31	Channel Configured	HEVC	None		0x20000
17-May-18 18:05:41	Close Alarms	HEVC	None		0x20000
17-May-18 18:05:41	Channel Stopped	HEVC	None		0x10100
17-May-18 18:04:26	Target Connection OK	HEVC	None	ping 192.168.123.188 OK	0x10000
17-May-18 18:04:26	Zixi Connection Failed	HEVC	OFF	ZIXI CONNECTION SUCCESS:Zixi ...	0x10040

The Configurations Page

ProHD BR-EN900 allows you to save screen shots of various configurations to be loaded manually or automatically in the future.

In the **Configurations** page you can add, activate, and delete channel configurations.

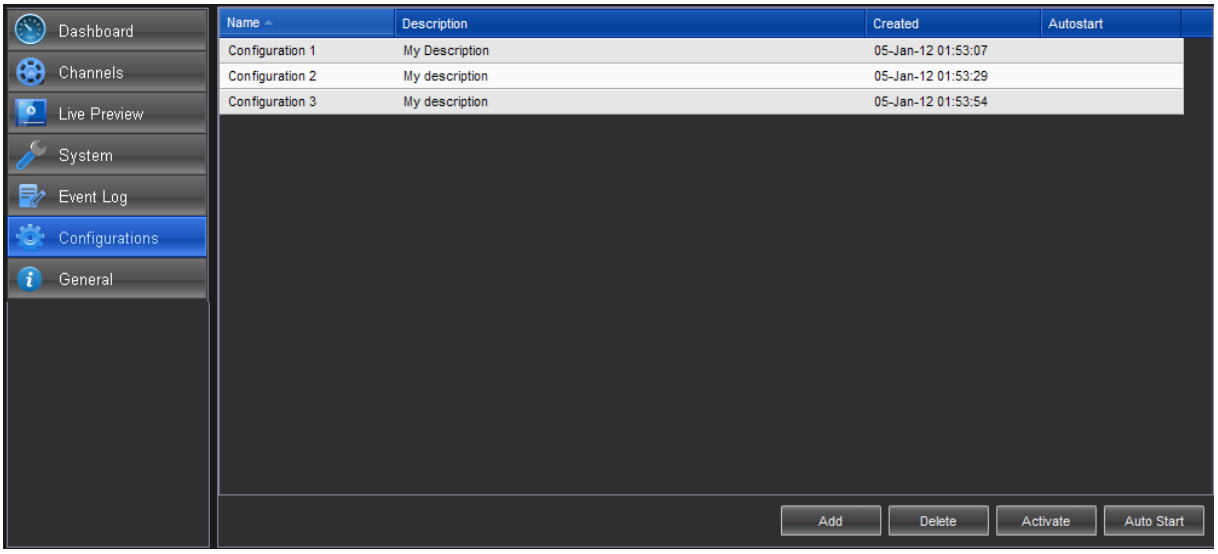
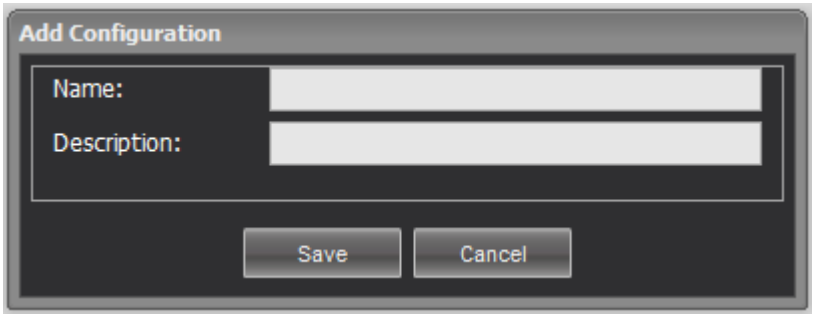


Figure 4-14: The Configuration page

To add a configuration:

1. Click **Add.**



2. Type the configuration name and description.
3. Click **Save**. The new configuration appears in the top row.

To activate a configuration:

1. Select the desired configuration row.
2. Click **Activate** to activate the configuration. The activated configuration is applied.

To delete a configuration:

1. Select the desired configuration row.
2. Click **Delete** to delete the configuration.

To activate Auto Start:

1. Select the desired configuration row.
2. Click **Auto Start.** The ✓ icon appears in the Auto Start column in the relevant configuration row.

   The next time the appliance restarts, the selected configuration will load automatically.

NOTE:

The video sources must be the same ones used when the configuration was created for auto-start configuration successful load.

The General Page

In the **General** page you can view appliance related parameters and perform license and firmware upgrades.

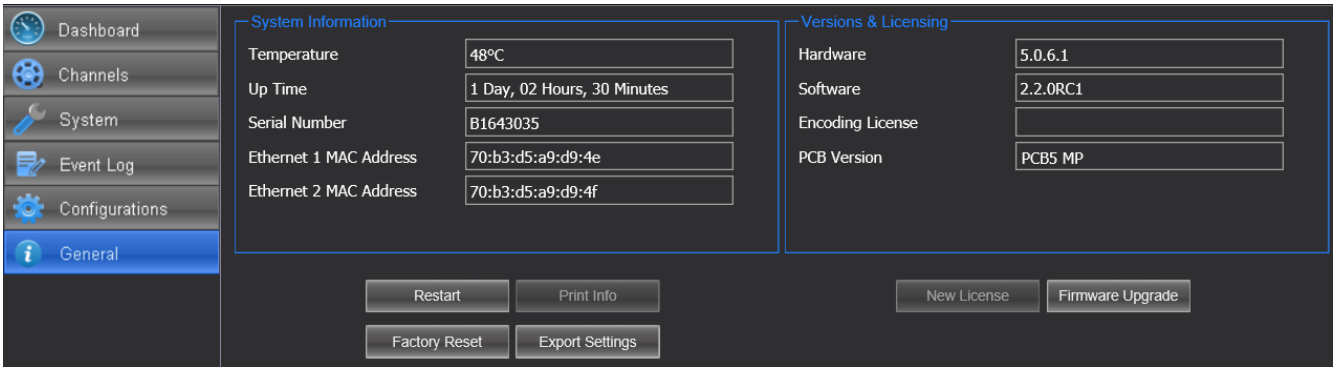


Figure 4-15: The General page

To view the System Information parameters:

Parameter	Description
Temperature	Displays the internal temperature of the appliance (in Celsius).
Up Time	Displays the time since last restart.
Serial Number	Displays the hardware serial number.
Ethernet 1 MAC Address	Displays the Network Interface #1 MAC Address.
Ethernet 2 MAC Address	Displays the Network Interface #2 MAC Address.

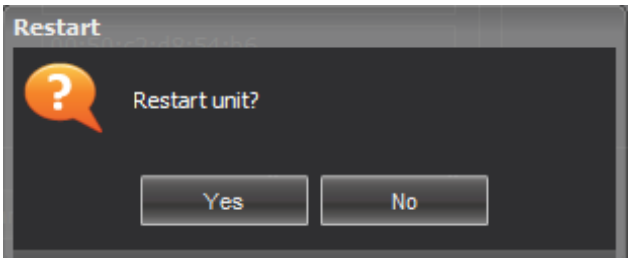
To view software and hardware version & licensing info:

Parameter	Description
Hardware	Displays the current hardware revision.
Software	Displays the active software version.
Encoding License	For future use.
PCB Version	Displays the PCB version.

To set Version & Licensing refer to License and Upgrade.

General Page Functions

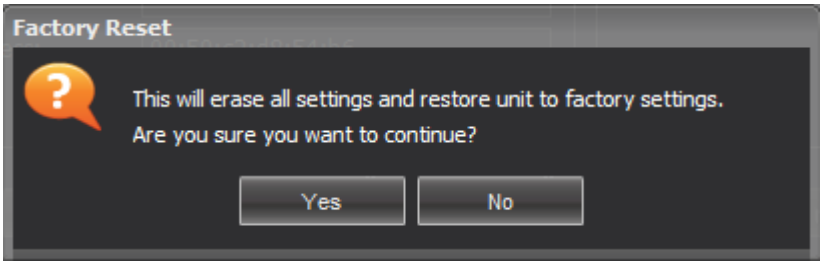
- Click **Restart** to restart the appliance. The **Restart** window appears.



- Click **Factory Reset** to reset all values to default factory values. The **Factory Reset** window appears.

NOTE:

The Factory Reset function will return the unit to its default IP settings: 192.168.1.1 with subnet mask 255.255.255.0. If you are connected to the unit from a PC on a different subnet, reconfigure your computer to the 192.168.1.x subnet to gain access to the unit and modify its settings for network use.



- Click **Export Settings** to enable the export of system parameters currently being used to a file. The output file **"devesettings.tgz"** can be shared with JVC Technical Support team during the process of remote troubleshooting.

- Click **Print Info** to obtain a printed summary of vital system information.

CHAPTER 5

ProHD BR-EN900 Reset

In This Chapter

Resetting ProHD BR-EN900 Settings

The appliance can be reset in one of the following ways:

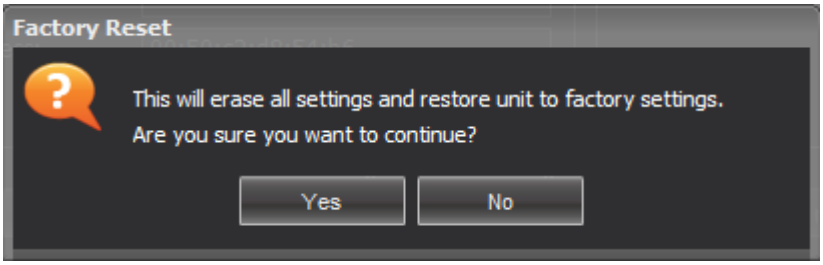
- A hardware reset.
- A software reset.

To reset the ProHD BR-EN900 (Hardware):

1. On the ProHD BR-EN900 front panel press the **RESET** button. A Short press will restart the appliance, long press (8 seconds) will cause return unit to factory settings.

To reset the ProHD BR-EN900 (through the application):

1. In the **General** page, click **Factory Reset** to reset all values to default factory values.



2. Click **Yes.** When reset completes, the appliance will return to factory state with the following default values:
   - **IP address: 192.168.1.1** (network interface # 1)
   - **Password: jvc1234**.

All saved channel configurations will be erased.

CHAPTER 6

Firmware Upgrade

In This Chapter

Upgrading the Firmware

Important Notes Prior to Upgrade

JVC periodically releases new firmware versions that include critical updates as well as feature enhancements.

ProHD BR-EN900 firmware and software upgrade process involves uploading a "firmware file" from within the unit HTTPS user interface, allowing the unit to extract the required files and perform internal updates. Uploading time of the "firmware file" may vary from one computer to another. It also depends on network speed and the connection's quality between the computer and the ProHD BR-EN900 appliance.

To verify if the upgrade had finished, observe the physical power LED on the appliance's front panel - blinking LED indicates that the upgrade is still ongoing. A solid LED indicates that the upgrade is completed and the appliance is ready for re-login. Log on using a new browser tab.

Read carefully the step-by-step procedure below and pay extra attention to notes and warnings.

To upgrade ProHD BR-EN900 Firmware version:

1. Send JVC your upgrade firmware request.
2. Before starting the upgrade procedure, disconnect all video and audio sources. Only power and Ethernet cables should remain connected.
3. Delete all saved configurations, including auto start configurations.

NOTE:

If not deleted, old configurations may cause the ProHD BR-EN900 to load into an unsupported state.

4. Click the **General** tab.

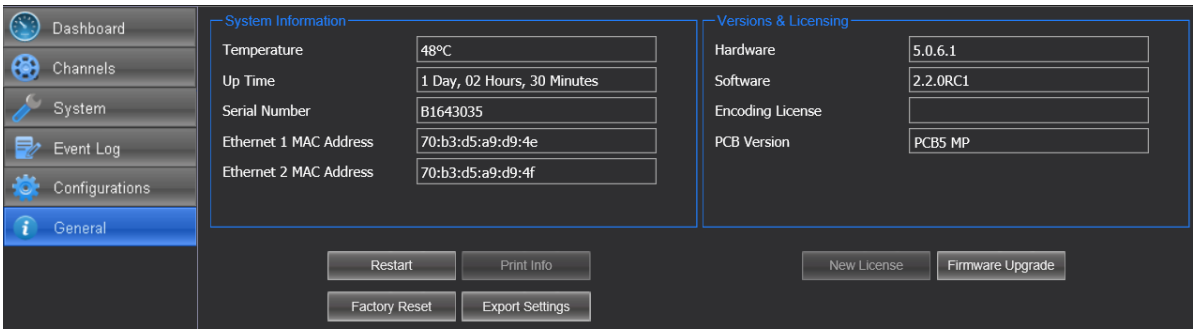


Figure 6-1: The General page

5. Click **Firmware Upgrade.** The **Load Firmware** window appears.

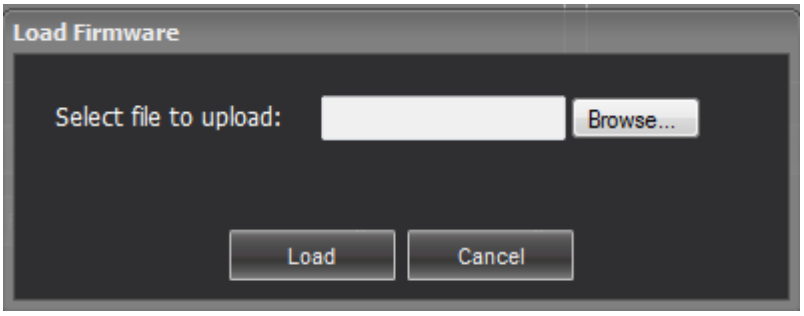


Figure 6-2: The Load New Firmware Upload window

6. Click Browse. A browser window opens.

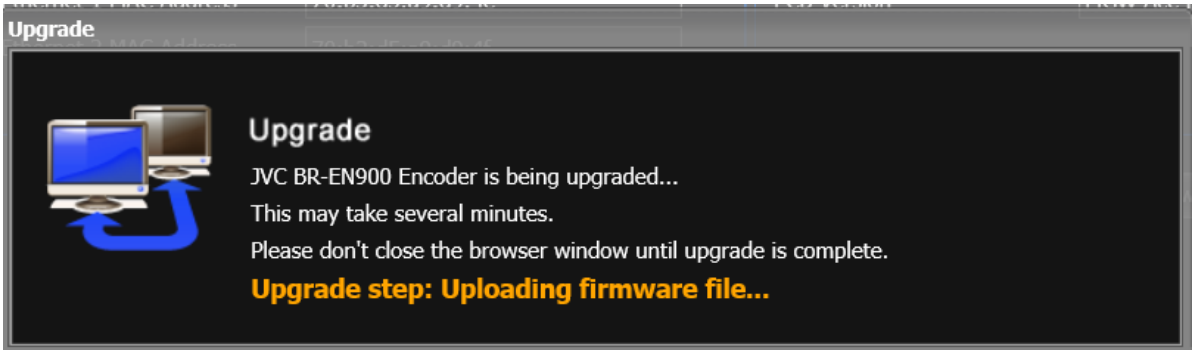
7. Select the appropriate ***.tar** file and click **Load.** The new version is loaded.

NOTE:

In case the upgrade file name or its extension is not recognized, and the following warning message appears, contact JVC customer support.

Figure 6-3: Firmware Upgrade Warning Message

- The **Upgrade** window appears on the screen, indicating the progress of the upgrade process:



- The Power green LED on the ProHD BR-EN900 appliance front panel is blinking.

The loading process might take a few minutes.

- When loading completes, the power LED stops blinking for a few seconds. The appliance will now start its update and reset processes, and the power green LED starts blinking faster. The reset process might take a few minutes.

WARNING:

The internet browser on your computer attempts to poll the appliance's status throughout the execution of the update and reset. Allow the reset process to complete without any intervention. Do not attempt to refresh the browser or take any other actions during the reset process.

- When reset completes, the power green LED is steady on and the login window appears (see figure below).

- If the login window does not appear open a new browser tab. Insert (in the URL field) the IP address that was set to the ProHD BR-EN900 prior to the upgrade. If the login window appears close the previous browser tab and proceed to step 7.

Figure 6-4: The Login window

8. Log on (refer to the Logging on section for details).

NOTE:

The login process to an upgraded appliance might be slow in the first time you log on after the upgrade. It might take a few minutes for the login to complete. Do not interfere with the login process.

9. In the **General** screen, verify that the upgrade was successful by inspecting the software **Version** in the **Versions and Licensing** section.

CHAPTER 7

ProHD BR-EN900 Playback

In This Chapter

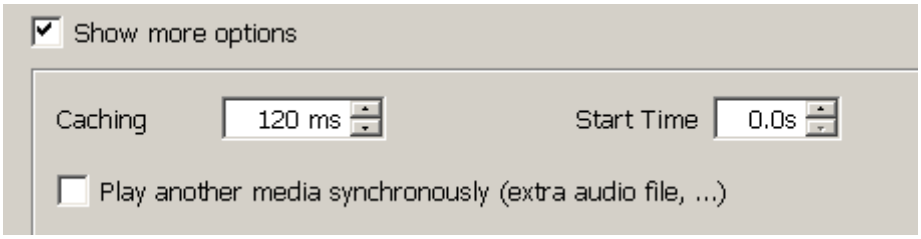
Playing ProHD BR-EN900 Video Streams

The ProHD BR-EN900 streams can be played using JVC Decoders or third party decoders that support the relevant compression standards. While MPEG-4 H.264 decoders are widely available from many vendors, decoding of real-time advanced HEVC streams is offered only by selected manufacturers. For HEVC decoding solutions by JVC you may use BR-DE900 hardware appliance or software players. For recommendations on third-party decoders, consult JVC or JVC’s Channel Partners.

Below are few recommended third-party common software decoders. Please note that the highly popular VLC Player features very basic support for HEVC streams. While certain configurations may work well on VLC - various advanced HEVC compression tools ProHD BR-EN900 uses are not yet supported by VLC. If you encounter abnormal behavior with VLC version 3.x (or higher version) use one of JVC's professional HEVC decoders. Note that VLC does not support proper rendering of interlaced HEVC streams.

Using VLC as the Player for HEVC and H.264 Streams

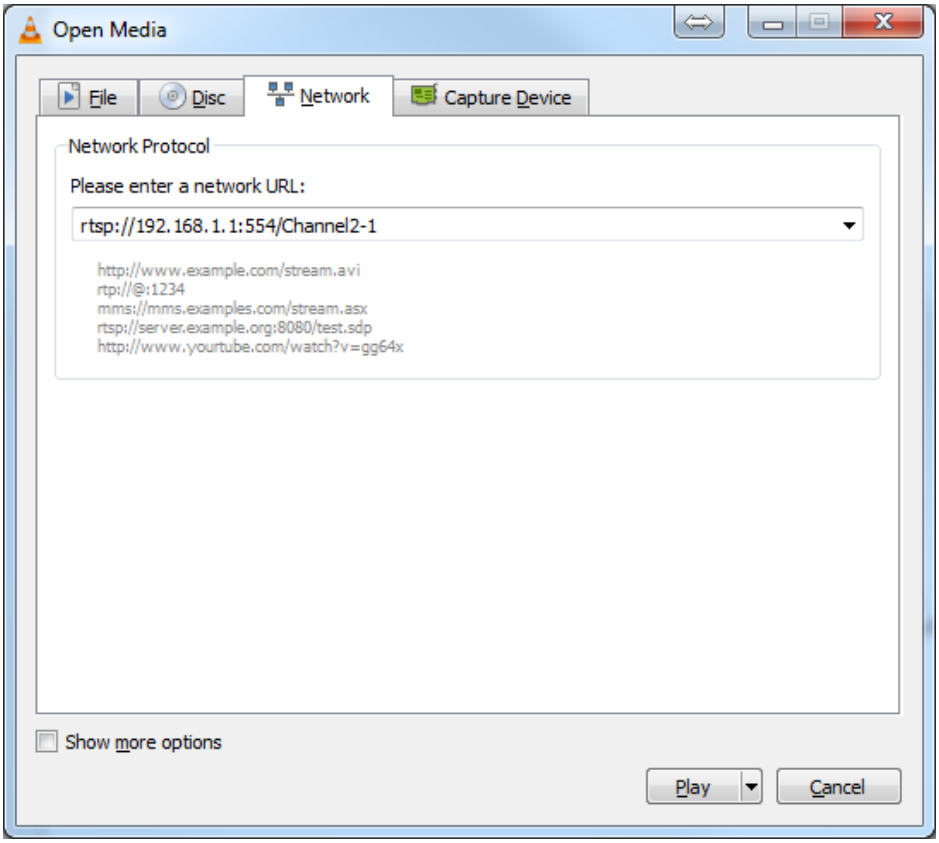
1. Invoke VLC Media Player.
2. Select **Media>Open Network Stream**. The Open Media window appears.
3. Set **Caching** by Clicking the **Show more options** box and set the caching to a value between **120** to **140** milliseconds depending on your network performance:



4. Select the **Network** tab and depending on the encoding mode and the selected streaming protocol (UDP TS, RTP TS, Pro-MPEG**,** and RTP ES), enter the following syntax in the URL field:

   - **For RTP ES Streams:**

   rtsp://<MGW IP Address>:<RTSP Server Port>/<CHANNEL NAME> (see example in figure below).

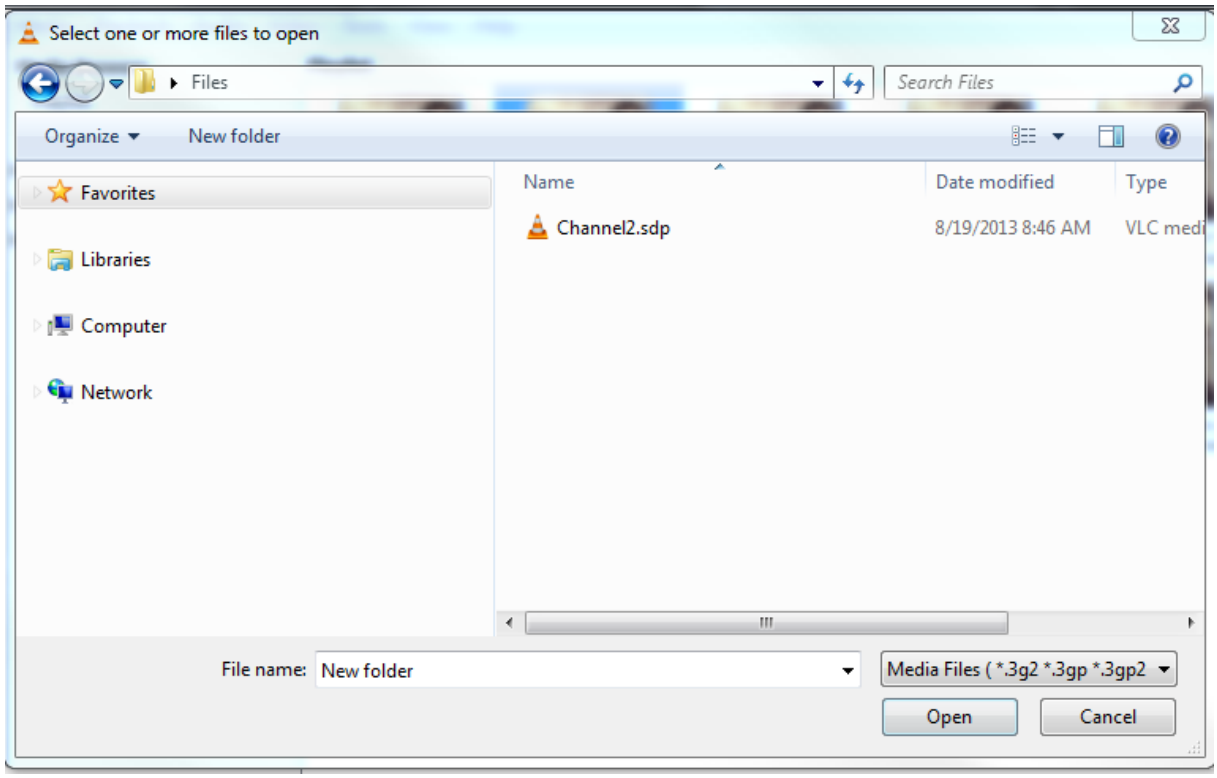


- Or

Retrieve the SDP file from the appliance using any method of your preference with the following https syntax "**https://<ProHD BR-EN900 IP Address>/sdp/<CHANNEL NAME>.sdp**". After SDP file is retrieved and accessible, use VLC's **File>Open** to upload it.

NOTE:

- URL syntax is case sensitive so ensure that the channel name is initial letter is capitalized.
- The IP address is the ProHD BR-EN900 IP address.
- Channel Name is the name as set on the **Channels** page, **Target** section.

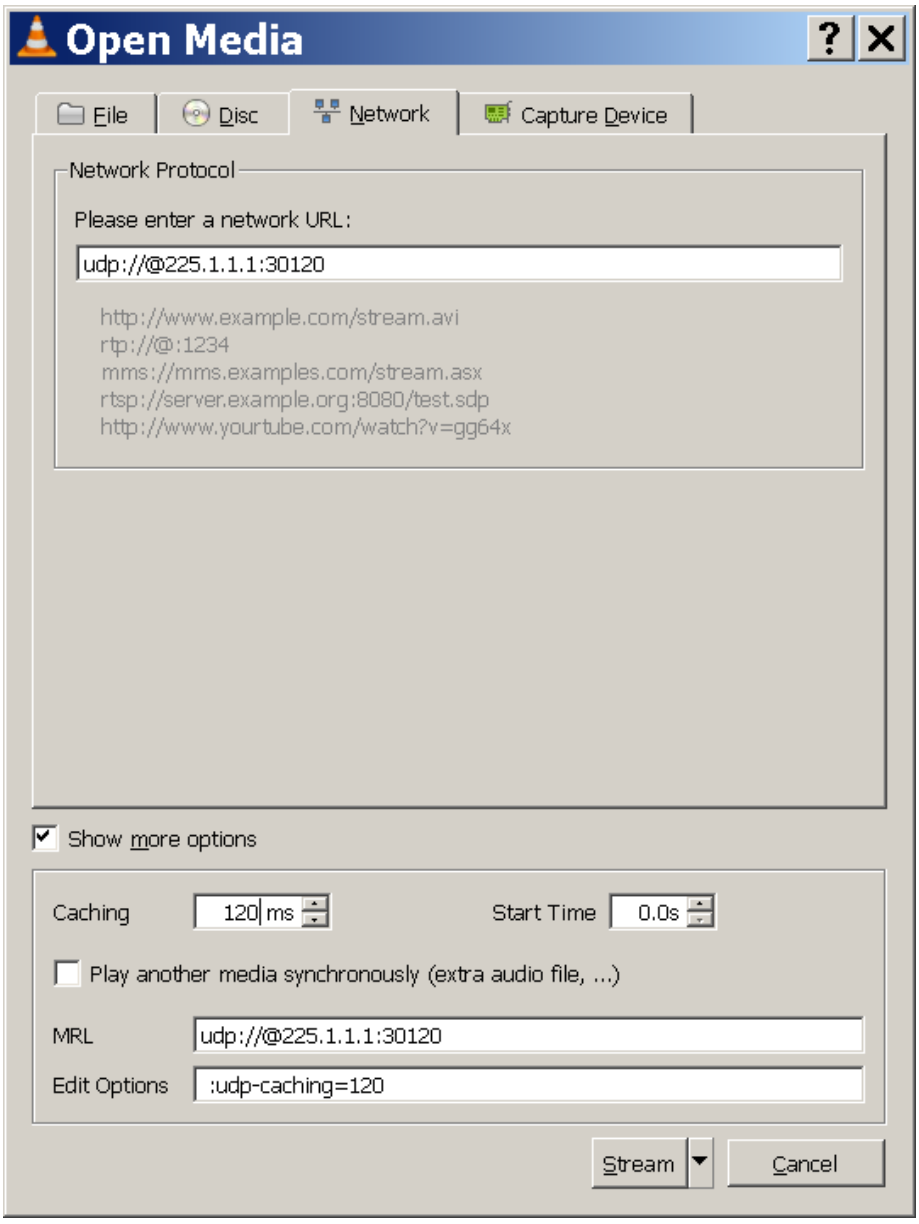


- **For UDP TS Streams:**

udp://@<Target IP Address>:<TargetPort>

NOTE:

- Older versions of VLC do not require "@" symbol.
- IP address is the Target Address as set on the Channels page, Target section.
- The port number is the **Target Port** as set on the **Channels** page, **Target** section.



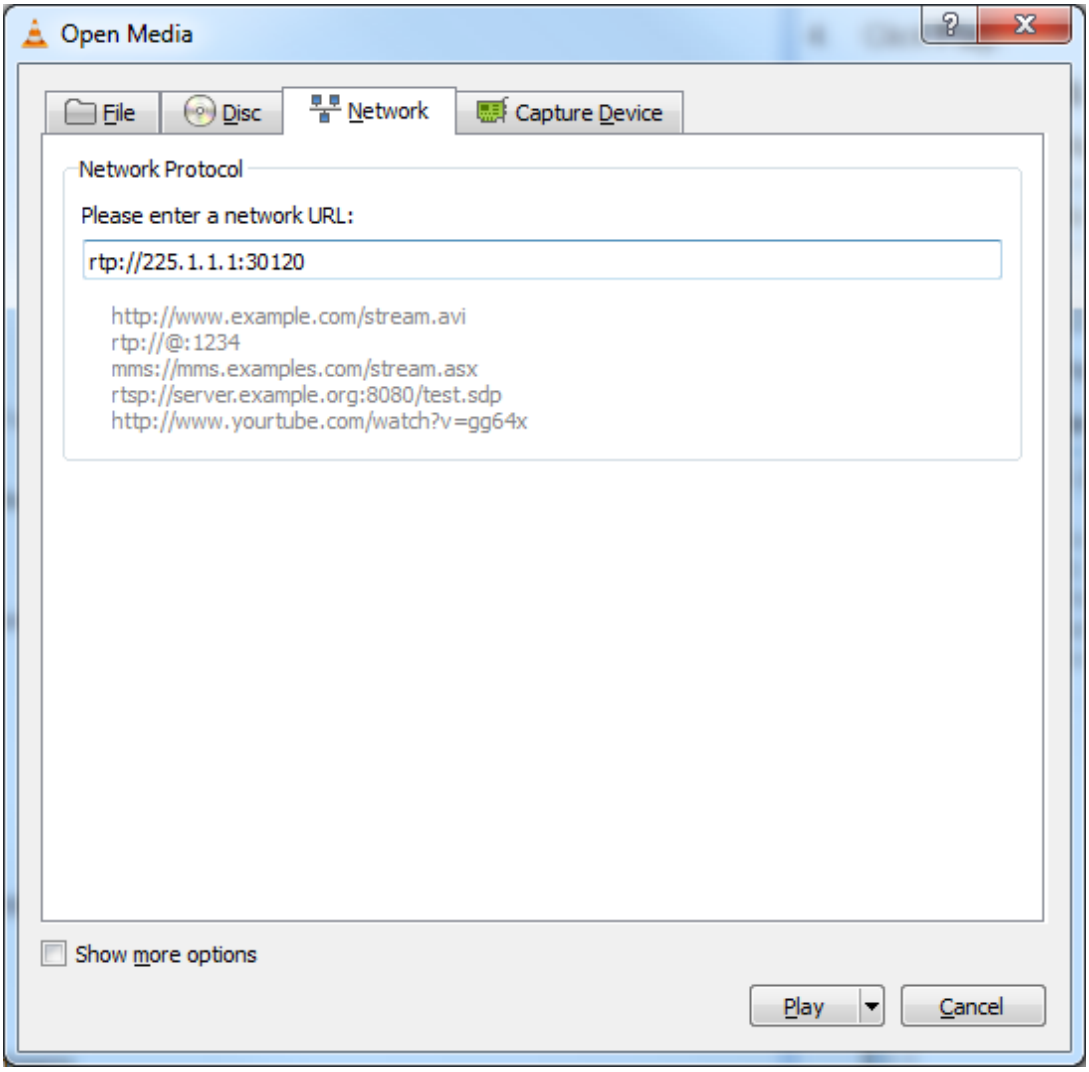
NOTE:

Configure the buffer size according to your network performance and the compression settings of the streams. When B-Frames are used, it is recommended to set VLC UDP buffer to 300 to allow for smooth playback. To reduce end-to-end latency when B-Frames are not in use, you may set the UDP buffer size to as low as 100 ms, depending on your network characteristics. In certain network environments you may need to adjust the decoder buffers to large size to allow for smooth playback while maintaining minimal latency.

5. Click **Play.**

- **For RTP TS or Pro-MPEG Streams:**

rtp://<Target IP Address>:<TargetPort>



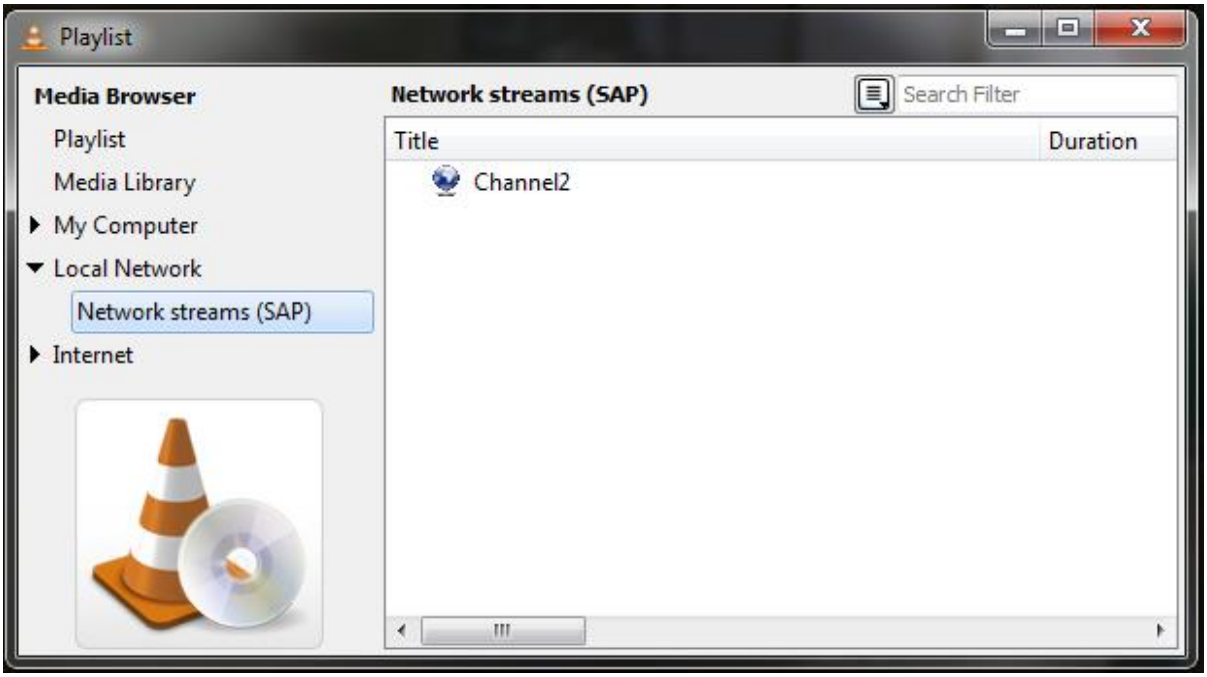
NOTE:

- VLC doesn't support FEC so while it is possible to play Pro-MPEG stream, no error correction will occur.
- Older versions of VLC do not require "@" symbol.
- IP address is the Target Address as set on Channels page, Target section.
- The port number is the **Target Port** as set on the **Channels** page, **Target** section.

To set VLC Player using SAP protocol:

The following procedure is only applicable for UDP streaming mode.

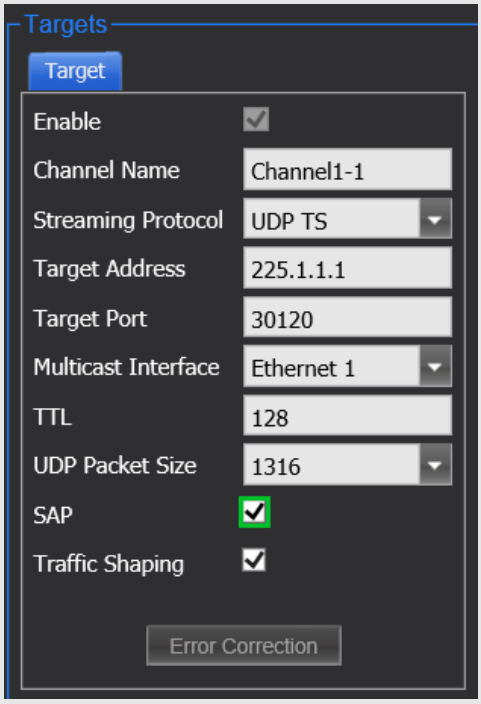
1. From VLC main menu select **View>Playlist.** The **Playlist** window appears.
2. Under **Media Browser,** expand **Local Network** and select **Network Stream.** A list of available streams appears.



3. Select the desired stream you wish to play.

NOTE:

SAP must be activated in **Channels** page, **Target** section, as shown in figure below.

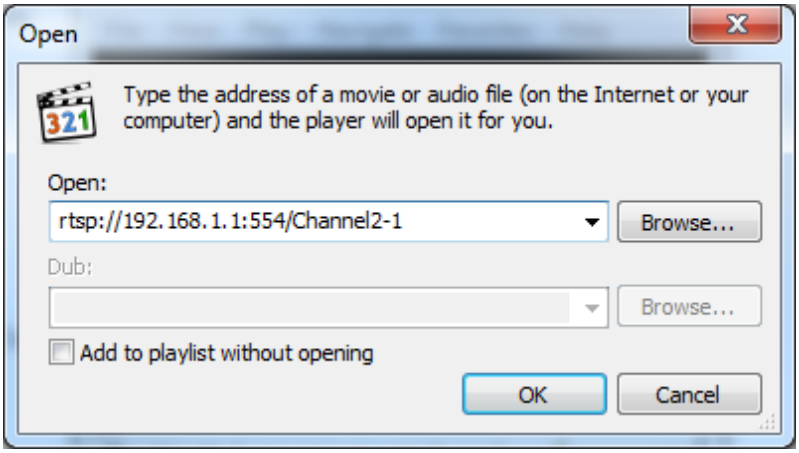


Using Media Player Classics for HEVC, and H.264 Streams

1. Invoke MPC-HC (Media Player Classics Home Cinema).
2. Select **File>Open File**.

- **For RTP ES Streams:**

rtsp://<MGW IP Address>:<RTSP Server port>/<CHANNEL NAME> (see example in figure below).

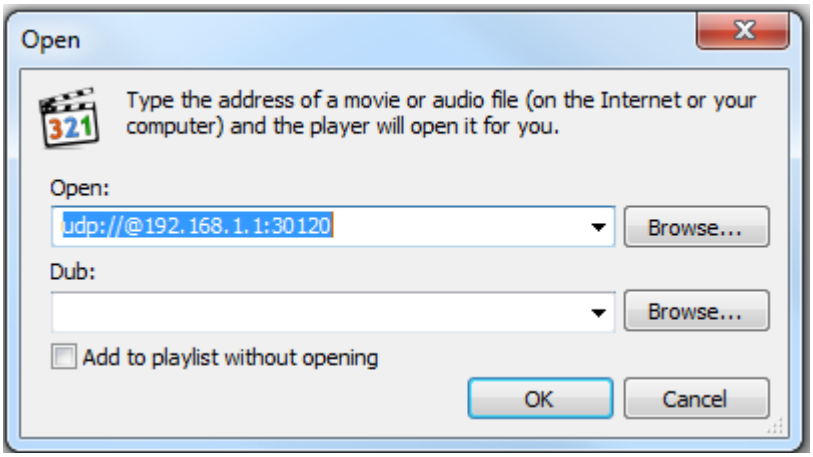


NOTE:

- URL syntax is case sensitive so ensure that the channel name initial letter is capitalized.
- The IP address is the ProHD BR-EN900 IP address.
- Channel Name is the name as set on the **Channels** page, **Target** section.

- **For UDP TS Streams:**

udp://@<Target IP Address>:<TargetPort>

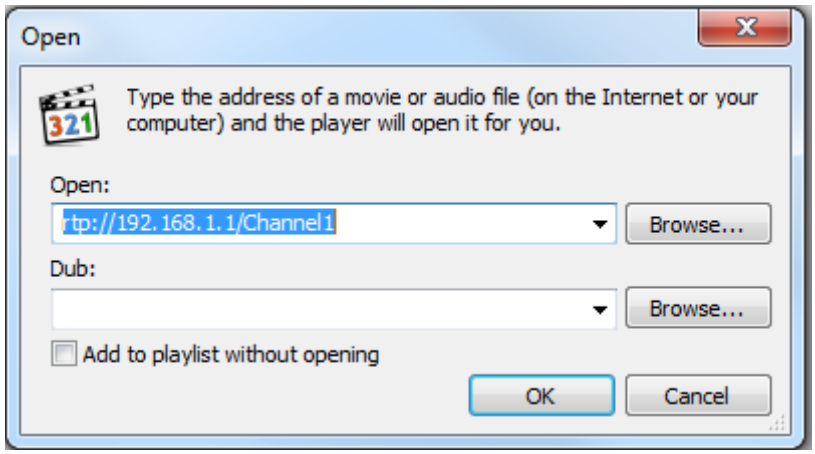


NOTE:

- IP address is the Target Address as set on the Channels page, Target section.
- The port number is the **Target Port** as set on the **Channels** page, **Target** section.

- **For RTP TS or Pro-MPEG Streams:**

rtp://<Target IP Address>:<TargetPort>



NOTE:

- MPC doesn't support FEC so while it is possible to play Pro-MPEG stream, no error correction will occur.
- IP address is the Target Address as set on the Channels page, Target section.
- Channel Name is the name as set on the **Channels** page, **Target** section.

3. Click **OK.**

Decoding Zixi and Pro-MPEG Streams (HEVC and H.264)

Zixi™ protected streams and Pro-MPEG protocol are not supported by open source free software players such as VLC or MPC.

You may use JVC ProHD BR-DE900 (HEVC/H.264), JVC zRAMP . Pro-MPEG streams may be decoded by 3rd party decoders that support SMPTE-2022 protocol.

Setting and Playing Zixi™ Channels

To send Zixi streams to the Zixi Broadcaster Server:

In the Channels page Target section:

1. Enter the Zixi Broadcaster server's **IP address** and **Port** (see Target table above).
2. Click **Error Correction Settings.** The **Zixi Settings** window opens. Enter the following parameters:

- **Password:** Enter the password for streaming to a Zixi™ receiver (Server or a Stand-alone decoder).

NOTE:

The password you enter must be identical to the password entered in the JVC zRAMP Web interface).

- **Latency:** Enter a latency value in milliseconds to be used for correcting errors. The minimal latency value must be three times higher than the RTT (Round Round Time) value that is used between the encoder and the targeted decoder. RTT value is available in Zixi Statistic window (see The Dashboard Page (on page 26) after the Zixi channel has been started.

  Additionally, higher latency increases tolerance to network errors (range 500-6000 milliseconds). The actual error correction rates depend also on the stream bit-rate. On average, 500ms latency yields protection of up to 6% of network errors. 6000ms latency yields protection of up to 30% of network errors.

  Check the Zixi Channel Statistic window (see The Dashboard Page on page 26) to monitor the packet loss of the transmission link used and set the latency accordingly.
- **Enable Dynamic Bit-rate Control:** Select the check box to allow either JVC decoder or Broadcaster Server to automatically change the encoding bit-rate while streaming.

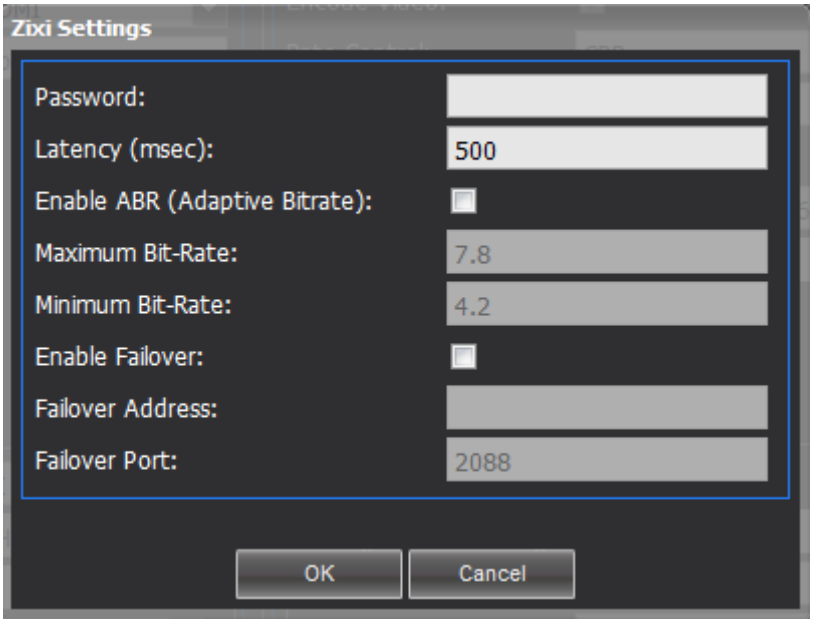


Figure 7-1: The Zixi Settings window

In the JVC zRAMP Web interface:

1. Add a new input stream. The **stream ID** must match ProHD BR-EN900 Channel Name that was entered in the **Channels page>Target section> Channel Name** field, and it is case sensitive.
2. Select **Push**.

> **NOTE**:
>
> **Latency** is set by the ProHD BR-EN900.

3. Click **OK**, the input channel is created.

To play the Zixi channel:

1. Click the play icon in the Dashboard Frame, **Control** column (H.264 or H.265 channels). "Zixi" is indicated in the **FEC** column (see The Dashboard Frame (on page 23)).

> **NOTE**:
>
> If error occurs and "Zixi" appears in red, ensure that:
>
> - ProHD BR-EN900 has access to the JVC zRAMP.
> - The channel was created correctly on the JVC zRAMP.

APPENDIX A

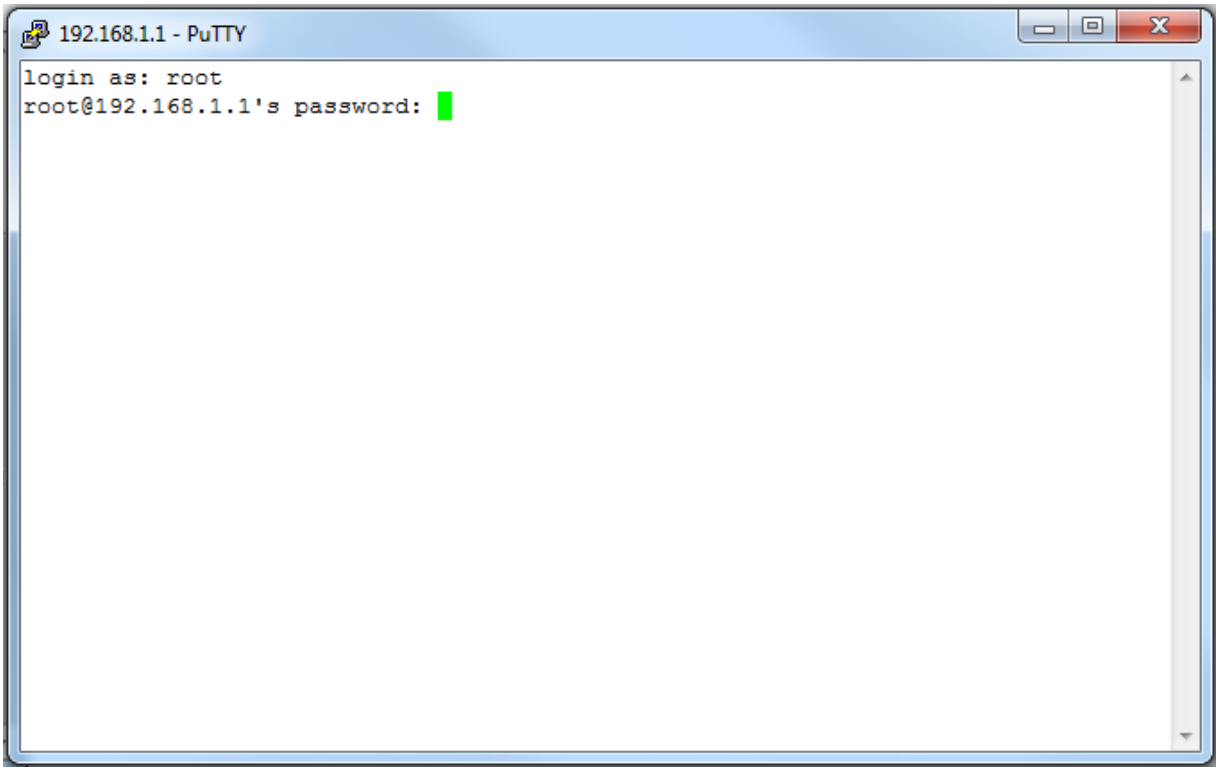
Network Configuration using an SSH Client

NOTE:

Only one connection can be used at a time.

To configure the appliance's network settings using an SSH client:

1. Open an SSH terminal window (PuTTY is the recommended tool).
2. Connect to the ProHD BR-EN900 IP address.
3. At the login prompt, type **"root"** and at the password prompt type the password (the default is **"jvc1234")**.



The main menu appears:

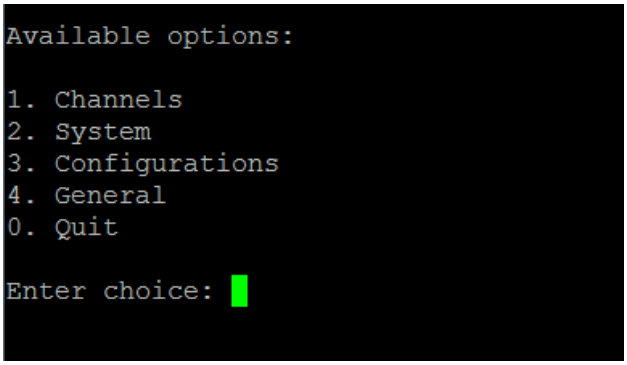


Figure 7-1: The Main Menu window

4. Press **"2"** for **System** option.

Figure 7-2: The System window

5. Type **"1"** for **"Network Interfaces"**

6. Type **"1"** for the **Change TCPIP settings for streaming interface** option.

Figure 7-3: The Network Interface -TCPIP Settings window

If you wish to enable DHCP type **"1"** and when prompted type **"y"**.

If you wish to set TCP/IP parameters manually, type **"2"** for **Disable DHCP and set TCP/IP parameters manually** and set the following values:

- Enter the appliance's new IP address.
- Enter the appropriate subnet mask.
- Enter your default gateway address.

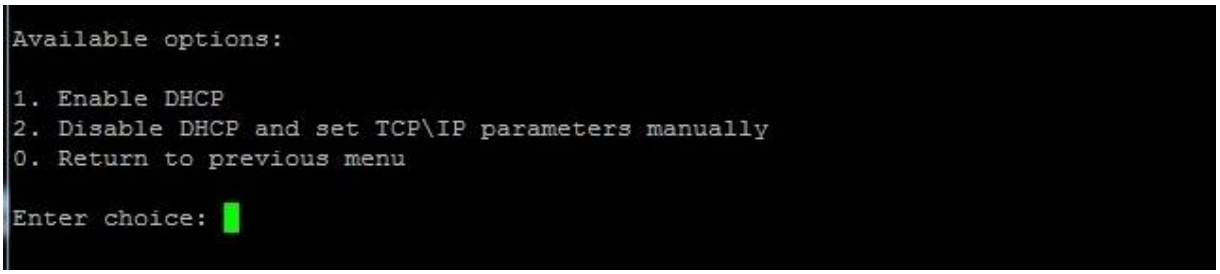


Figure 7-4: The TCPIP Settings window

CAUTION:

If you have changed the appliance's IP address to a different subnet you may need to reconfigure your computer network settings to re-connect to the appliance.

To change the date and time using an SSH client:

1. In the **System** window, type **"3"** for the **Date and Time** option. The following window appears:

Figure 7-5: The Date and Time window

2. Type **"1"** for setting the date and time.

To configure SAP using an SSH client:

1. In the **System** window, type **"4"** for the **SAP** option. The following window appears:

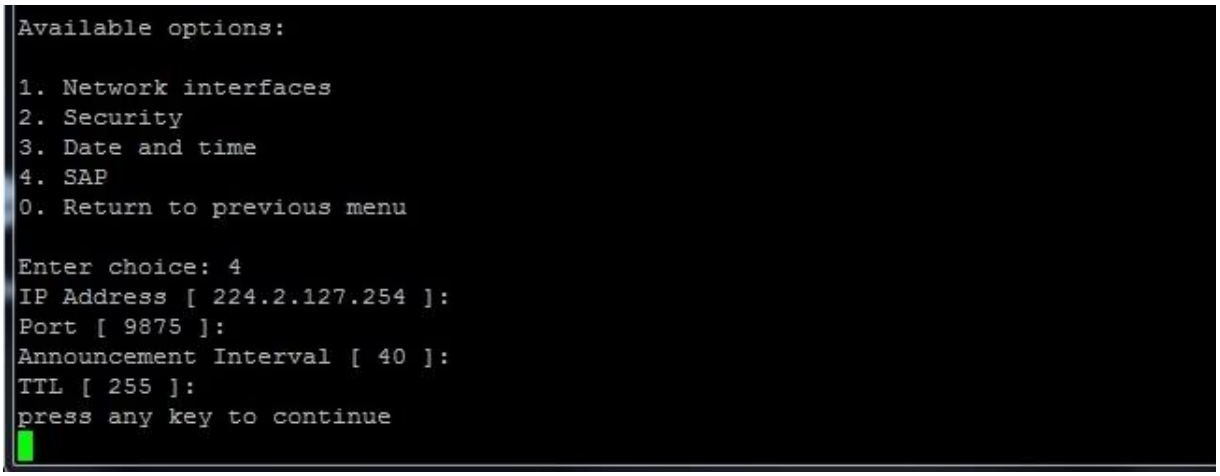


Figure 7-6: The System window - SAP window

2. Enter the IP Address, Port (number), Announcement Interval and TTL values.

To configure the appliance's host name for the first time using an SSH client:

1. From the main menu screen, type "**2"** for the **Security"** option. The following window appears:

Figure 7-7: The Security window

2. Type "**2**" for the **Change hostname** option and type the new host name.

To configure channel parameters for the first time using an SSH client:

1. From the main menu screen, type **"1"** for the "**Channels**" option. The following window appears:

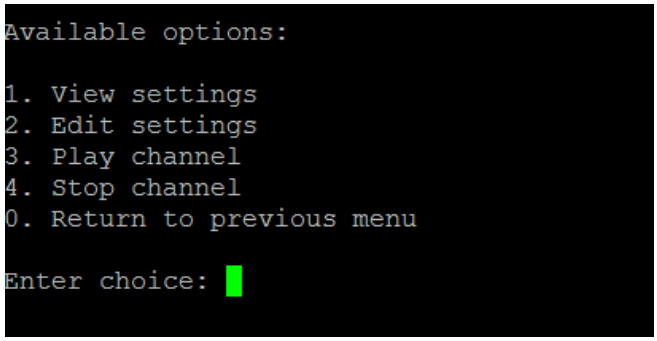


Figure 7-8: The Channels window

2. Either view, edit or change the channel playing state by typing the corresponding option number.

To set various parameters of channel configurations:

1. From the main menu screen, type **"3"** for the "**Configurations**" option. The following window appears:

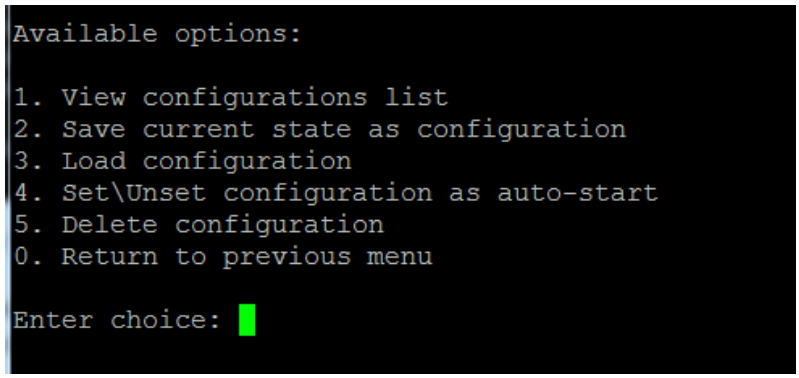


Figure 7-9: The Configurations window

2. Either view, save, load, delete or set a configuration as auto-start by typing the corresponding option number.

To restore default settings or restart the appliance:

1. From the main menu screen, type **"4"** for the "**General**" option. The following window appears:

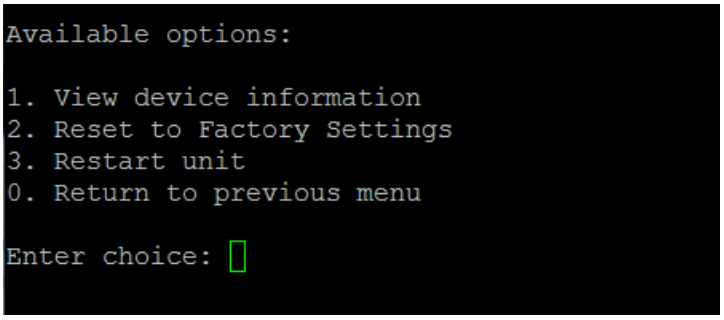


Figure 7-10: The General window

2. Either view device information, restore default settings or restart the appliance by typing the corresponding option number.

When done, follow SSH "Exit" instructions on screen and close the SSH window to save the settings.

APPENDIX B

Technical Specifications

Compliance

- FCC Part 15, Class A
- CE
- ICES-003
- RoHS

Environmental

- Operating Temperatures: -20 ºC to +50 ºC (-4 ºF to 122 ºF)
- Storage Temperatures: -40 ºC to +70 ºC (-40 ºF to 158 ºF)
- Relative Humidity: 5% to 95% (non-condensing).

Physical

- Dimensions: 2.55" H x 7.71" W x 7.83" D (65mm H x 196mm W x 199mm D)
- Weight: 4.85lb (2.2kg)
- Enclosure: Industrial-grade
- Status LED's for power, network activity, Temperature and Fan Errors, streaming and video source indications
- Mounting holes for seamless installation in vehicles / onto flat surfaces.

Functional Description

Inputs

Video Inputs

- 1 x 3G/HD-SDI/SD-SDI (SMPTE 259M-C, SMPTE 292M, SMPTE 274M, SMPTE 296M, SMPTE 424M, SMPTE 425M-A)
- 1 x HDMI v1.3 (support for HDCP and non-HDCP protected sources)
- 1 x DVI-D
- 1 x Composite/CVBS.

Input Resolutions / Frame Rates Support

- 2048x1080p25, 24, 23.976
- 1920x1080p @ 60, 59.94, 50, 30, 29.97, 25, 24, 23.976 Hz
- 1920x1080i @ 60, 59.94, 50 Hz
- 1600x1200p @ 60, 50 Hz
- 1400x1050p @ 60,50 Hz
- 1440x900p @ 60, 50 Hz
- 1366x768p @ 60, 50 Hz
- 1280x800p @ 60, 50 Hz
- 1280x1024p @ 60, 50 Hz
- 1024x768p @ 60, 50 Hz
- 1280x720p @ 60, 59.94, 50, 30, 29.97, 25 Hz
- 720x480p @ 59.94 Hz
- 720x480i @ 59.94 Hz
- 720x576p @ 50 Hz
- 720x576i @ 50 Hz.

Audio Inputs

- SDI Embedded audio (PCM support)
- HDMI Embedded audio (PCM support)
- 1 x Analog unbalanced stereo audio, AC-coupled (RCA Female)
- 1 x Balanced analog stereo audio (XLR).
- 2 x unbalanced digital stereo audio (BNC)

Audio Output (Talkback)

- 1 x Analog unbalanced stereo audio, AC-coupled (RCA Female)

Stream Output Protocols

Network Protocols

- UDP TS
- RTP TS
- RTP ES with RTSP server
- RTMP (H.264)
- Zixi™ Error-Correction with ABR mode (Adaptive Bit-Rate)
- RTP TS with ProMPEG Forward Error Correction (SMPTE 2022).

Video Output - HEVC (H.265)

MPEG-H HEVC (ISO/IEC 23008-2) Modes:

- Main / Main 10 and Main 4:2:2: up to 4:2:2 10-bits
- Level up to level 5.2, Main and High Tier
- GOP: I, IP, IB, IBBBP, IBBBBBBBP
- Bit Rate: 100 Kbps - 30Mbps
- Frame Rate: 1-60 fps.
- Bit Rate Regulation Modes: Constant (CBR), Variable (VBR)
- Output Resolutions: Configurable from CIF up to 1920x1080
- Encoding Latency: Low latency mode down to 75 Milliseconds
- Error resiliency modes (High / Medium / Off).

Video Output - MPEG-4 AVC/H.264

MPEG-4 AVC/H.264 (ISO\IEC 14496-10 MPEG-4 AVC – Rec. ITU-T H.264) Modes:

- Baseline Profile L3
- Main Profile L3 and L4
- High Profile L4 and L4.2
- Bit Rate: 100 Kbps - 15 Mbps
- Frame Rate: 10-60 fps.
- Bit Rate Regulation Modes: Constant (CBR), Variable (VBR)
- Output Resolutions: Configurable from CIF up to 1920x1080
- Encoding Latency: 65 milliseconds.

Audio Output

MPEG-4 AAC-LC (ISO/IEC 14496-3), MPEG-1 L2

- Stereo and mono modes
- Bit Rate: 32Kbps - 192Kbps in Stereo, 16Kbps - 128Kbps in Mono
- Sampling Rate: 16 kHz - 48 kHz.

APPENDIX C

Technical Support

The JVC's Products Knowledge Base is part of our web site http://pro.jvc.com It offers technical tips, downloads of user manuals, access to latest firmware files and general information about IPTV products.

Warranty

Limited Hardware Warranty Terms

Subject to the terms and conditions specified below your JVC product (the **"Product"**) is warranted against defects in material and workmanship (the "Warranty") for a period of 12 (twelve) months following the Delivery Date (the **"Warranty Period"**). The Warranty provided to you hereunder supersedes any warranty which may be provided to you by the original manufacturer of the Product.

JVC (collectively "**company**") will repair or replace (at its option) any defective part during the Warranty Period, provided that (i) the Warranty remains in force. Your dated sales receipt or invoice shall be considered as the delivery date of the Product form JVC's premises to your designated address (the "**Delivery Date**"); (ii) your Product unit carries a serial number on its rear panel; (iii) you received from JVC Customer Service department a Return Materials Authorization (RMA) number. No Product unit will be accepted for repair without RMA number; and (iv) the entire Product unit is returned to the company by prepaid shipping in JVC's original packaging.

JVC will not be responsible for (i) any damages resulting from the use, maintenance or installation of any Product; or (ii) for the incorporation of any spare or replacement parts not approved by the company.

Without limiting the generality of the foregoing, The company reserves the right to refuse to provide any services under the Warranty for any Product that, in the company opinion, has been subjected to any abnormal electrical, mechanical, or environmental abuse, or shows signs of modification by an unauthorized person or company. Call your local distributor or reseller for out-of-warranty repair charge estimates prior to returning a product.

You acknowledge that the product licensed or sold hereunder, which may include technology and software, are subject to the export control laws and regulations of the United States ("U.S.") and/or any other country in which the product is received. You agree that you will not knowingly transfer, divert, export or re-export, directly or indirectly, the product, including the software, the software source code, or technical data (as defined by the U.S. Export Administration Regulations) restricted by such regulations or by other applicable national regulations to any person, firm, entity country or destination to which such transfer, diversion, export or re-export is restricted or prohibited by U.S. or other applicable law, without obtaining prior authorization from the U.S.

Department of Commerce and other competent government authorities to the extent required by those laws.

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